FURUNO

OPERATOR'S MANUAL

MARINE RADAR

Model **FCR-21x9**
FCR-21x9-BB
FCR-28x9

FURUNO ELECTRIC CO., LTD.

www.furuno.com

(Elemental Chlorine Free)

The paper used in this manual
is elemental chlorine free.

FURUNO ELECTRIC CO., LTD.

9-52 Ashihara-cho,
Nishinomiya, 662-8580, JAPAN

・FURUNO Authorized Distributor/Dealer

 Printed in Japan

A : JUN. 2012
B2 : OCT. 03, 2013

Pub. No. OME-36040-B2

(DAMI) FCR-2119-BB

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IMPORTANT NOTICES

General

- This manual has been authored with simplified grammar, to meet the needs of international users.
- The operator of this equipment must read and follow the descriptions in this manual. Wrong operation or maintenance can cancel the warranty or cause injury.
- Do not copy any part of this manual without written permission from FURUNO.
- If this manual is lost or worn, contact your dealer about replacement.
- The contents of this manual and equipment specifications can change without notice.
- The example screens (or illustrations) shown in this manual can be different from the screens you see on your display. The screens you see depend on your system configuration and equipment settings.
- Save this manual for future reference.
- Any modification of the equipment (including software) by persons not authorized by FURUNO will cancel the warranty.
- All brand and product names are trademarks, registered trademarks or service marks of their respective holders.
- "C-MAP" means "C-MAP by Jeppesen" in this manual.
- Windows is a registered trademark of the Microsoft Corporation of the USA and other countries.

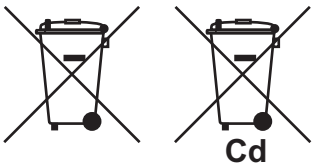
How to discard this product

Discard this product according to local regulations for the disposal of industrial waste. For disposal in the USA, see the homepage of the Electronics Industries Alliance (http://www.eiae.org/) for the correct method of disposal.

How to discard a used battery

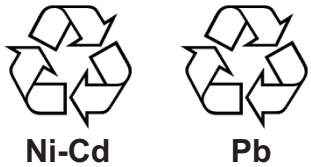
Some FURUNO products have a battery(ies). To see if your product has a battery, see the chapter on Maintenance. Follow the instructions below if a battery is used. Tape the + and - terminals of battery before disposal to prevent fire, heat generation caused by short circuit.

In the European Union



The crossed-out trash can symbol indicates that all types of batteries must not be discarded in standard trash, or at a trash site. Take the used batteries to a battery collection site according to your national legislation and the Batteries Directive 2006/66/EU.

In the USA



The Mobius loop symbol (three chasing arrows) indicates that Ni-Cd and lead-acid rechargeable batteries must be recycled. Take the used batteries to a battery collection site according to local laws.

In the other countries

There are no international standards for the battery recycle symbol. The number of symbols can increase when the other countries make their own recycle symbols in the future.

SAFETY INSTRUCTIONS

The operator must read the safety instructions before attempting to operate the equipment.

WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

Warning, Caution Prohibitive Action Mandatory Action

WARNING

Radio Frequency Radiation Hazard

The radar antenna emits electromagnetic radio frequency (RF) energy that can be harmful, particularly to your eyes. Never look directly into the antenna aperture from a close distance while the radar is in operation or expose yourself to the transmitting antenna at a close distance. Distances at which RF radiation level of 100, 50 and 10 W/m² are given in the table below.

Radar model	Transceiver	Magnetron	Antenna*	100W/m²	50W/m²	10W/m²
FCR-2119(-BB)/ 2819	RTR-078A	MAF1565N	XN20AF	0.1m	0.7m	2.2m
			XN24AF	0.1m	0.4m	1.5m
FCR-2129(-BB)/ 2829	RTR-079A	MG5436	XN20AF	0.5m	1.7m	4.6m
			XN24AF	0.2m	1.0m	3.3m
FCR-2139S(-BB)/ 2839S	RTR-080	MG5223F	SN36AF	0.1m	0.7m	2.0m
FCR-2829W	RTR-081A	MG5436	XN20AF	0.4m	1.0m	5.6m
			XN24AF	0.2m	0.5m	3.4m
FCR-2839SW	RTR-082	MG5223F	SN36AF	-	0.2m	1.9m

* XN20AF: 198cm, XN24AF: 243cm, SN36AF: 377cm

⚠ WARNING

Do not open the equipment.

The equipment uses high voltage that can cause electrical shock. Refer any repair work to a qualified technician.

Before turning on the radar, be sure no one is near the antenna.

Prevent the potential risk of being struck by the rotating antenna, which can result in serious injury or death.

If water leaks into the equipment or something is dropped into the equipment, immediately turn off the power at the switchboard.

Fire or electrical shock can result.

If the equipment is giving off smoke or fire, immediately turn off the power at the switchboard.

Fire or electrical shock can result.

If you feel the equipment is acting abnormally or giving off strange noises, immediately turn off the power at the switchboard and contact a FURUNO service technician.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Make sure no rain or water splash leaks into the equipment.

Fire or electrical shock can result if water leaks into the equipment.

Do not place liquid-filled containers on or near the equipment.

Fire or electrical shock can result if a liquid spills into the equipment.

⚠ WARNING

Do not operate the equipment with wet hands.

Electrical shock can result.

Keep objects away from the open-type antenna unit, so as not to impede rotation of the antenna.

Fire, electrical shock or serious injury can result.

Use the proper fuse.

Use of the wrong fuse can cause fire or damage the equipment.

The TT function is a valuable aid to navigation. However, the navigator must check all aids available to avoid collision.

- The TT automatically tracks an automatically or manually acquired radar target and calculates its course and speed, indicating them with a vector. Since the data generated by the TT depends on the selected radar targets, the radar must be optimally tuned for use with the TT, to ensure required targets will not be lost or unnecessary targets, like sea returns and noise, will not be acquired and tracked.

- A target is not always a landmass, reef, ship, but can also be returns from the sea surface and from clutter. As the level of clutter changes with the environment, the operator must correctly adjust the sea and rain clutter controls and the gain control so that the target echoes do not disappear from the radar screen.

⚠ CAUTION

The plotting accuracy and response of this TT meets IMO standards. Tracking accuracy is affected by the following:

- Tracking accuracy is affected by course change. One to two minutes is required to restore vectors to full accuracy after an abrupt course change. (The actual amount depends on gyrocompass specifications.)
- The amount of tracking delay is inversely proportional to the relative speed of the target. Delay is approx. 15-30 seconds for the higher relative speed; approx. 30-60 seconds for the lower relative speed. The following factors can affect accuracy:
  - Echo intensity
  - Radar transmission pulse length
  - Radar bearing error
  - Gyrocompass error
  - Course change (own ship and targets)

Handle the LCD carefully.

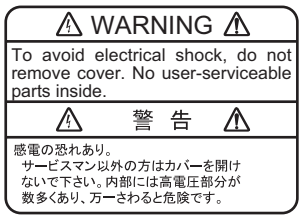
The LCD is made of glass, which can cause injury if broken.

The data presented by this equipment is intended as a source of navigation information.

The prudent navigator never relies exclusively on any one source of navigation information, for safety of vessel and crew.

Warning Label(s)

Warning label(s) is(are) attached to the equipment. Do not remove the label(s). If a label is missing or damaged, contact a FURUNO agent or dealer about replacement.



Name: Warning Label 1
Type: 86-003-1011-1
Code No.: 100-236-231

Name: Warning Sticker
Type: 03-142-3201-0
Code No.: 100-266-890

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FOREWORD

Congratulations on your choice of the FURUNO FCR-21x9(-BB), FCR-28x9 Series Marine Radar. We are confident you will see why the FURUNO name has become synonymous with quality and reliability.

Since 1948, FURUNO Electric Company has enjoyed an enviable reputation for innovative and dependable marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

This equipment is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless installed, operated and maintained properly. Please carefully read and follow the recommended procedures for operation and maintenance.

Features

This radar series meets the requirements of IEC 62388 (Marine navigation and radiocommunication equipment and systems - Shipborne radar - Performance requirements, method of testing and required test results) and IMO MSC.192(79), IMO Resolution A.817(19), and IEC 61174. This radar displays radar targets, electronic charts, nav lines, Tracked Target (TT) data, AIS targets and other navigation data on a 23.1-inch display (FCR-28x9).

The main features of this series are

- The FCR-21x9(-BB), FCR-28x9 series consists of the following models and configurations:

Model	Frequency Band	Size of Monitor Unit	Output Power	Transceiver location
FCR-2119(-BB)	X-band	Local supply	12 kW	Antenna unit
FCR-2129(-BB)			25 kW	Antenna unit
FCR-2139S(-BB)			30 kW	Antenna unit
FCR-2819	X-band	23.1”*	12 kW	Antenna unit
FCR-2829	X-band		25 kW	Antenna unit
FCR-2829W	X-band		25 kW	Transceiver unit
FCR-2839S	S-band		30 kW	Antenna unit
FCR-2839SW				Transceiver unit

* Viewing distance: 1020 mm

- New HMI (Human Machine Interface) gives improved operability.
- Accepts SXGA, UXGA video inputs.
- SOLAS category 2 compatible display (320 mm). (Category 1 compatible display optionally available.)
- Radar, chart and chart radar modes. (The chart radar mode does not meet the criteria for navigation aid for Japanese flag vessels as defined by Japanese law.)
- Many warning features to support safer and more efficient navigation.
- Grounding warnings, safe depth contours.
- Chart database loaded and updated using CD-ROMs.
- Tracked Target (TT) data and AIS data to aid in collision avoidance.
- AIS messaging.
- Route created in chart mode can be displayed on the radar.
- Route planning and route monitoring facilities in the chart mode.

Signal Processing Functions

This radar has the signal processing functions described in the table below. All signal processing functions are set with the picture preset feature.

Signal processing function	Description	Section
Interference rejector	Suppress interference transmitted by other radars. Interference received simultaneously from many radars can be difficult to reduce.	2.14
Echo stretch	Enlarge target echoes, especially small echoes. Suppress interference, sea clutter and rain clutter before using echo stretch, to prevent the enlargement of unwanted echoes.	2.15
Echo averaging	The radar samples echoes with each scan. Targets that show a large change with each scan are judged as clutter and are reduced to display only echoes from legitimate targets.	2.16
Noise rejector	Suppress white noise and increase the S/N ratio to improve picture clarity.	2.17

Standards Used in this Manual

- Three types of Control Units are available: Radar Control Unit RCU-025 (radar controls with trackball module), ECDIS Control Unit RCU-024 (alphabet keyboard, controls, trackball module) and Trackball Control Unit RCU-026 (trackball module only). Unless noted otherwise, “Control Unit” refers to the RCU-025.
- The system can be operated with the controls of the Radar Control Unit, ECDIS Control Unit or a trackball module. The descriptions in this manual use the trackball module.
- Unless noted otherwise, "click" means to push the left button on a trackball module.
- The keys and controls of the Radar Control Unit are shown in bold face; for example, the **ENTER** key.
- The buttons on the InstantAccess bar, Status bar and menu items are shown in brackets; for example, the [TUNE] button.
- Context-sensitive menus are available with many buttons, and boxes and objects. Right-click an item to display the related context-sensitive menu.
- This radar is available in three types of specifications: IMO, A, or B. This manual provides the descriptions for the B type, of which some functions are not available with the IMO or A type. See the menu tree in Appendix 1 for function availability.
- “C-MAP” means “C-MAP by Jeppesen”.

Program Number

System	Program no.	Version no.
Radar		
SPU	0359204	03
RFC	0359202	01
EC-3000		
Main	0359266	01

Virus Prevention

The ECDIS is not equipped with a virus checker. The ECDIS operates in real time; therefore, having a virus checker that periodically checks the equipment for viruses would increase the processing load, which can affect operation. However, you can avoid viruses by following the instructions in this section.

When you update a chart

The PC and medium (USB flash memory, etc.) used to download and store an update for an existing chart or a new chart may be infected with a virus. Check the PC and the medium for viruses with a commercial virus checker - BEFORE you connect them to the ECDIS. Be sure the virus checker contains the latest virus definition files.

Network connection

The ECDIS receives and displays information from various navigation equipment and radar via a LAN. A PC and other equipment connected to a network can carry viruses. To prevent the introduction of a virus to the LAN, DO NOT connect the ECDIS or HUB to an external network, including other shipboard LAN.

Do not install 3rd party programs in the ECDIS

Programs installed via an external network can carry viruses that can cause the ECDIS to malfunction. Do not install any Windows® software.

Open Source Software

This product includes software to be licensed under the GNU General Public License (GPL), GNU Lesser General Public License (LGPL), BSD, Apache, MIT and others. The program(s) is/are free software(s), and you can copy it and/or redistribute it and/or modify it under the terms of the GPL or LGPL as published by the Free Software Foundation. Please access to the following URL if you need source codes: https://www.furuno.co.jp/cgi/cnt_oss_e01.cgi

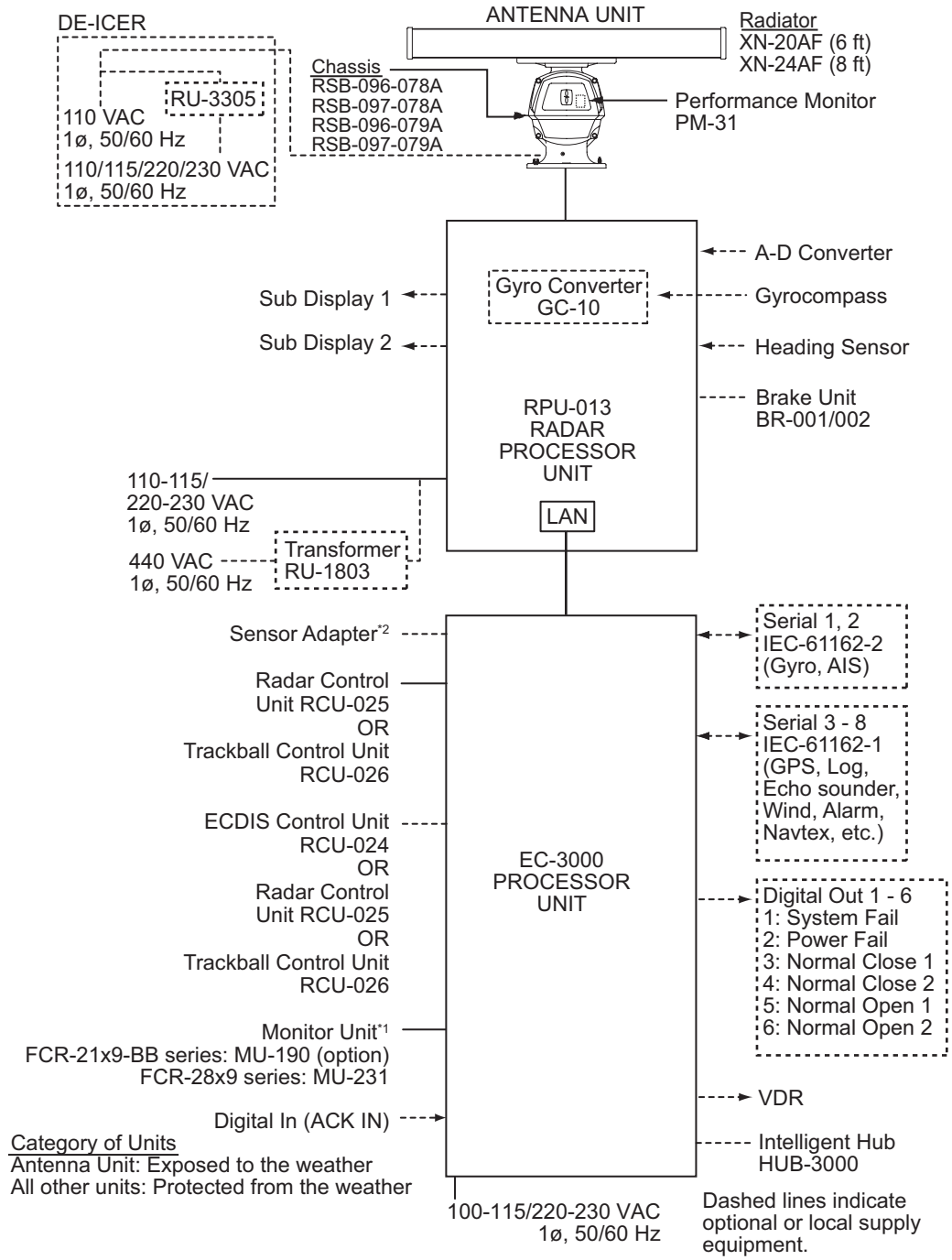
This product uses the software module that was developed by the Independent JPEG Group.

Reverse engineering

Reverse engineering (reverse assemble, reverse compiler) of the software of this equipment is prohibited.

SYSTEM CONFIGURATION

FCR-2119(-BB)/2129(-BB)/2139S(-BB)/2819/2829

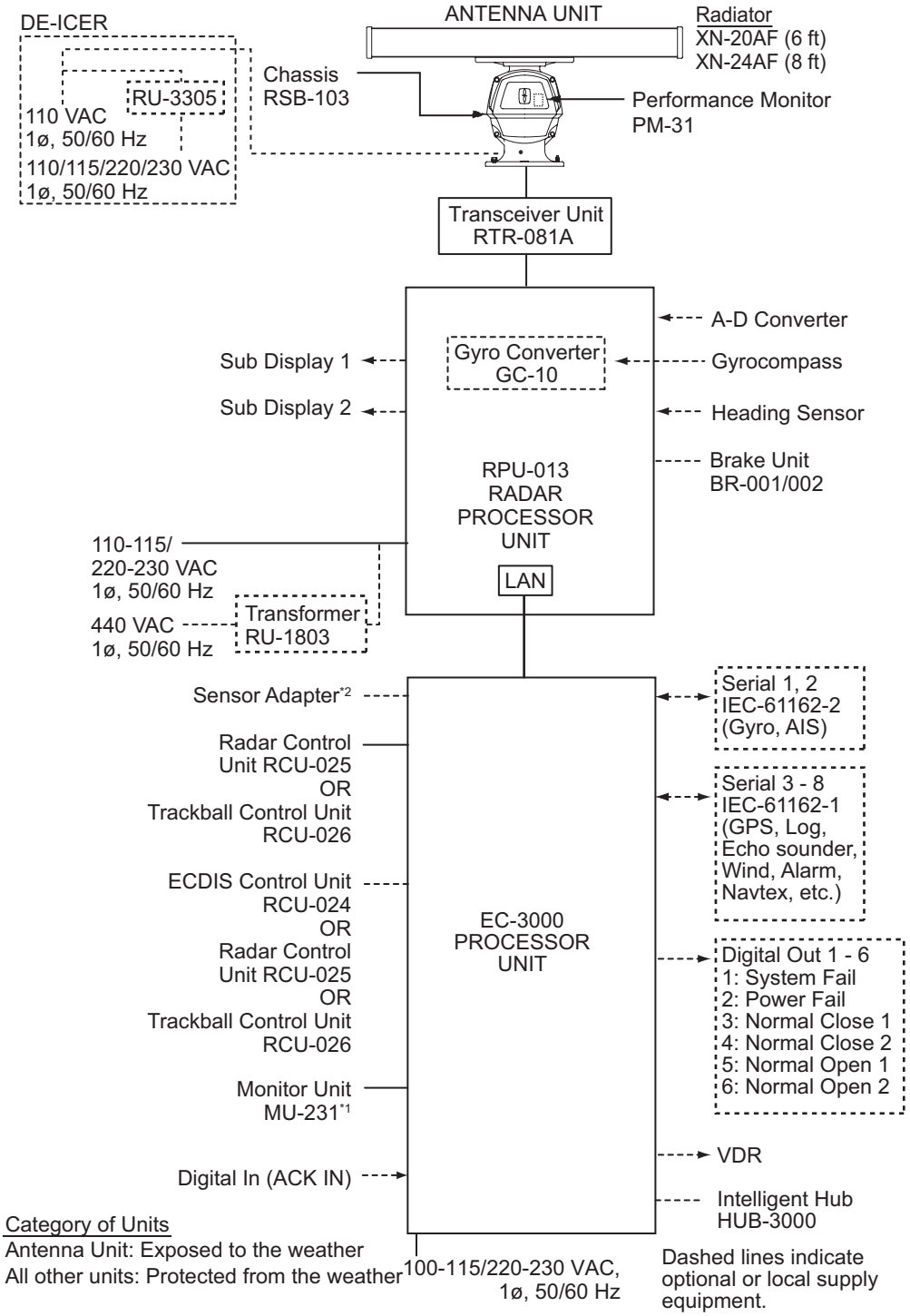


EPFS must meet MSC.112(73); SMDE must meet MSC.96(72). GPS speed data does not meet IMO requirements unless type approved for compliance with IMO resolution MSC.96(72). The update rate of the gyrocompass must be better than 40 Hz (HSC) or 20 Hz (other than HSC).

*1 These monitors have been approved by the IMO, MU-190 for CAT 2C and CAT 2HC, MU-231 for CAT 1C and CAT 1HC. If a different monitor is to be used on IMO vessels, its effective diameter must meet the applicable Category requirements:
CAT 1C and CAT 1HC: effective diameter 320 mm or higher
CAT 2C and CAT 2HC: effective diameter 250 mm or higher
For installation, operation and viewing distance of other monitor, see its manuals.

*2 Control Serial MC-3010S, Analog IN MC-3010A, Digital IN MC-3020D, Digital OUT MC-3030D

FCR-2829W

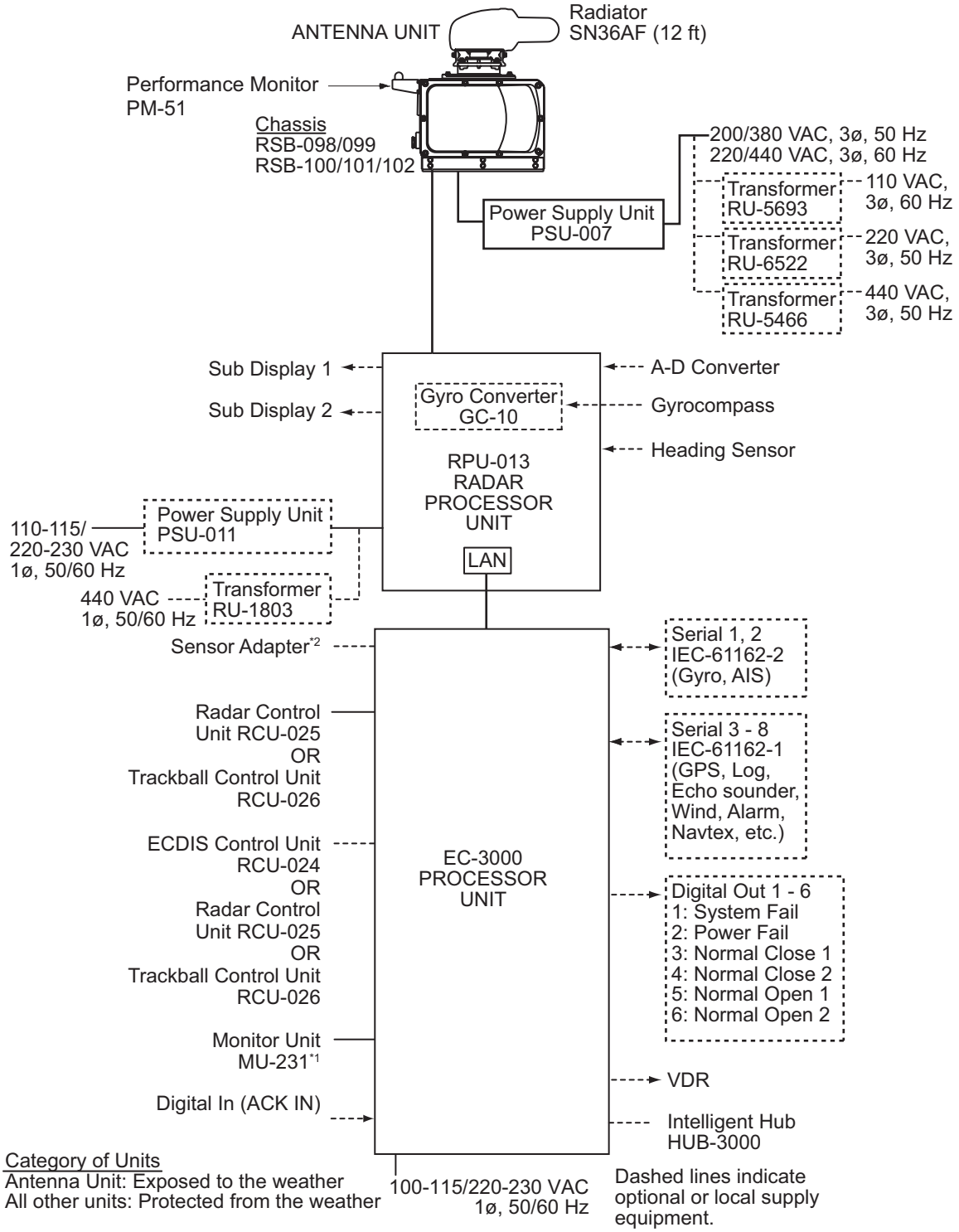


EPFS must meet MSC.112(73); SMDE must meet MSC.96(72). GPS speed data does not meet IMO requirements unless type approved for compliance with IMO resolution MSC.96(72). The update rate of the gyrocompass must be better than 40 Hz (HSC) or 20 Hz (other than HSC).

*1 The MU-231 monitor meets the Category requirements for CAT 1C and CAT 1HC. If a different monitor is to be used on IMO vessels, its effective diameter must meet the applicable Category requirements:
CAT 1C and CAT 1HC: effective diameter 320 mm or higher
CAT 2C and CAT 2HC: effective diameter 250 mm or higher
For installation, operation and viewing distance of other monitor, see its manuals

*2 Control Serial MC-3010S, Analog IN MC-3010A, Digital IN MC-3020D, Digital OUT MC-3030D

FCR-2839S



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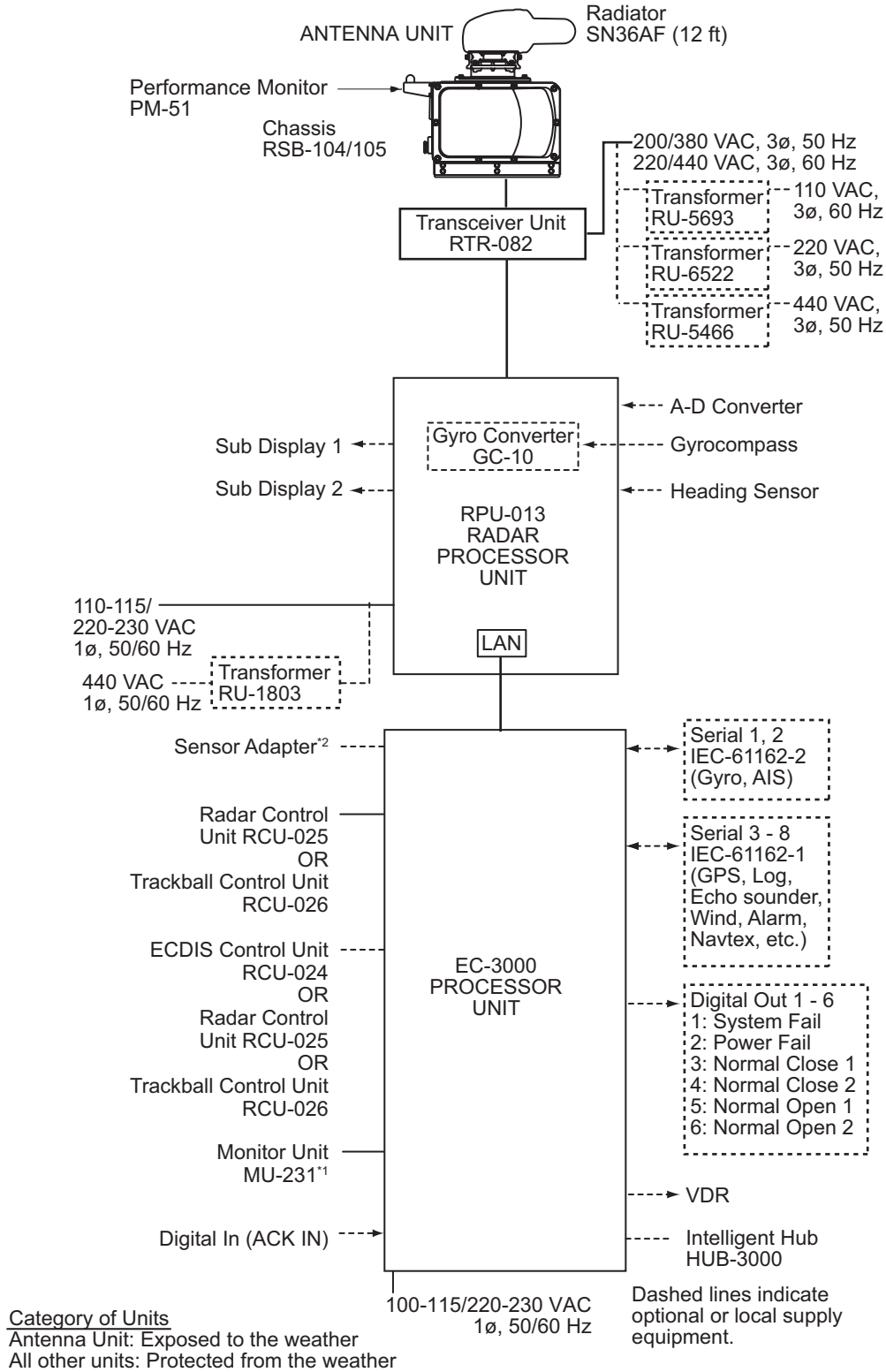
CAT 1C and CAT 1HC: effective diameter 320 mm or higher
CAT 2C and CAT 2HC: effective diameter 250 mm or higher
For installation, operation and viewing distance of other monitor, see its manuals

*2 Control Serial MC-3010S, Analog IN MC-3010A, Digital IN MC-3020D, Digital OUT MC-3030D

FCR-2839SW



Category of Units
Antenna Unit: Exposed to the weather
All other units: Protected from the weather

EPFS must meet MSC.112(73); SMDE must meet MSC.96(72). GPS speed data does not meet IMO requirements unless type approved for compliance with IMO resolution MSC.96(72). The update rate of the gyrocompass must be better than 40 Hz (HSC) or 20 Hz (other than HSC).

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For installation, operation and viewing distance of other monitor, see its manuals

*2 Control Serial MC-3010S, Analog IN MC-3010A, Digital IN MC-3020D, Digital OUT MC-3030D

1. OPERATIONAL OVERVIEW

1.1 Units of the System

1.1.1 Radar Control Unit RCU-025

The Radar Control Unit RCU-025 consists of various controls and a trackball module (trackball, scrollwheel and left and right buttons). The trackball module functions like a PC mouse. The user rolls the trackball and operates the left and right buttons and the scrollwheel to do various functions.

The RCU-025 has 28 direct access keys, five knob-type controls, two rotary encoders, a power switch, a USB port, and a trackball module. The system can be operated with the keys and controls or with the trackball module.

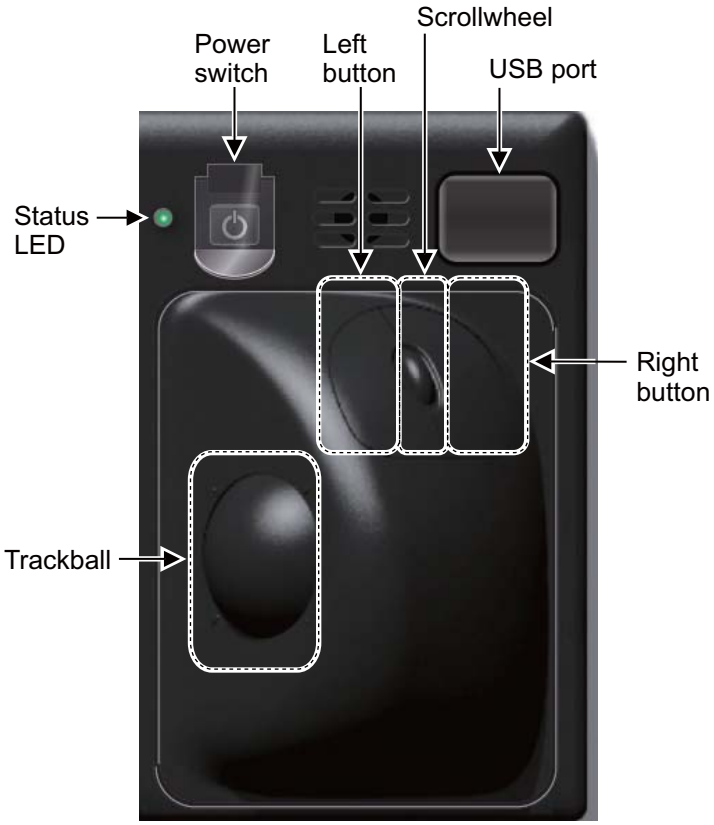
When you press the correct key, a single beep sounds to alert you to correct operation. For wrong operation, several beeps sound. You can select the loudness of the beep or deactivate the beep on the [OPERATION] menu.

Control	Description
	Turns the system on or off. (With a FURUNO monitor unit, the monitor is also turned on or off with this switch.)
Status LED	The color and state of the LED change according to system or alert status. **Green, lighting**: Normal operation status; no alerts generated. **Green, flashing**: The heater on the CPU board is on, because ambient temperature is not at least 0°C. The heater takes about two minutes to warm the equipment. The LED lights green after the heater goes off. **Red, lighting**: Acknowledged alert or SYSTEM FAIL. SYSTEM FAIL occurs when there is trouble in the Processor Unit or communication failure between the Processor Unit and an ECDIS Control Unit. Each Control Unit detects trouble and its lamp flashes in red and the buzzer sounds. If this condition occurs at the No. 1 ECDIS Control Unit, the SYSTEM FAIL signal is output. **Red, flashing**: Unacknowledged alert or SYSTEM FAIL.
Rotary control EBL1, EBL2	**Rotary control**: Rotates the active EBL. **EBL1, EBL2**: Activates or deactivates the respective EBL.
ALARM ACK	• Silences the aural alarm. • Acknowledges unacknowledged alert.
InstantAccess knob	Selects the buttons on the InstantAccess bar.
ESC	Goes back one step in current operating sequence on the InstantAccess bar.
BRILL	**Rotate**: Adjusts the brilliance of the display (FURUNO-supplied monitor only). **Push**: Selects a color palette.
A/C RAIN	**Rotate**: Suppresses rain clutter. **Push**: Toggles between manual and automatic rain clutter adjustment.
A/C SEA	**Rotate**: Suppresses sea clutter. **Push**: Toggles between manual and automatic sea clutter adjustment.
GAIN	Adjusts the sensitivity of the radar receiver.
HL OFF	• Temporarily erases everything but radar echoes when held down. • Enters the numeric 1. • Selects like-numbered menu item.
OFFSET EBL	• Activates or deactivates the offset EBL. • Enters the numeric 2. • Selects like-numbered menu item.
MODE	• Selects a presentation mode. • Enters the numeric 3. • Selects like-numbered menu item.
STBY/TX	Toggles the radar between standby and TX.
OFF CENTER	• Re-centers radar position at the cursor location. • Enters the numeric 4. • Selects like-numbered menu item.
CU/TM RESET	• **Course-up**: Resets heading line to 000°. • **True motion**: Moves own ship position 75% of the radius in stern direction. • Enters the numeric 5. • Selects like-numbered menu item.
INDEX LINE	• Selects an index line (in the PI line box). • Long press to activate or deactivate selected index line. • Enters the numeric 6. • Selects like-numbered menu item.
MENU	Opens, closes the menu.
VECTOR TIME	• Sets the vector time (length) for TT and AIS targets. • Enters the numeric 7. • Selects like-numbered menu item.

Control	Description
VECTOR MODE	• Sets the vector mode (relative, true). • Enters the numeric 8. • Selects like-numbered menu item.
TARGET LIST	• Displays AIS, TT data in the target list. • Enters the numeric 9. • Selects like-numbered menu item.
CANCEL	Cancels the changes made on the currently selected menu.
TRAIL	• Goes back one page in the menu. • Moves cursor leftward in text box. • Turns the echo trail display on or off. • Long-push to reset all trails.
PANEL	• Adjusts the backlighting of the keys. • Enters the numeric 0. • Selects like-numbered menu item.
MARK	• Goes forward one page in the menu. • Moves cursor rightward in text box. • Inputs selected mark on the radar screen, at the position selected.
ENTER	Confirms selection on menu.
Rotary control VRM1, VRM2	**Rotary control**: Adjusts the diameter of the active VRM. **VRM1, VRM2**: Activates or deactivates the respective VRM.
UNDO	Undo edit or text input on radar map.
VIEW/HIDE	**Radar mode, chart radar mode**: Shows or hides the AZ box, Drop mark boxes, EBLs, Mark box, PI line box, Trial box, VRMs. **Chart mode**: Shows or hides the EBLs, InstantAccess bar, [Overlay/NAV Tools] box, [Route information] box, VRMs.
RANGE	Selects radar range (radar and chart radar modes), chart scale (chart mode).
ACQ/ACT	• **TT**: Acquires target selected with cursor, for target tracking. • **AIS**: Activates cursor-selected sleeping AIS target.
TARGET DATA	Displays the detailed data for selected TT, AIS target, in the TT/AIS information box.
TARGET CANCEL	• **TT**: Stops tracking the cursor-selected tracked target. • **AIS**: Sleeps cursor-selected activated AIS target. • Long-push to erase all displayed TT target data.
Trackball module	The trackball module is the same as that used in the Trackball Control Unit RCU-026. See the description in the next section.
USB port	For connection of USB flash memory (FAT16 or FAT32 format). Do not connect a USB HDD or PC keyboard. The DVD drive (Maker: TEAC, Type: PU-DRV10) is for chart updates.

1.1.2 Trackball Control Unit RCU-026

The Trackball Control Unit RCU-026 has a power switch, a trackball module (trackball, scrollwheel and left and right mouse buttons), a status LED, and a USB port. The trackball module functions like a PC mouse; the user rolls the trackball and operates the left and right buttons and the scrollwheel to do various functions.



Control	Description
Power switch	Turns the system on or off. (With a FURUNO monitor unit, the monitor is also turned on/off with this switch.)
Status LED	The color and state of the LED change according to system or alert status. See the Status LED description on page 1-2.
Left button	• Does the operation related to the object selected. • Confirms the operation done for the object selected.
Scrollwheel	• Selects menu options. • Selects chart scale. • Sets numeric data. • The scrollwheel does not have a "push" function.
Right button	• Displays context-sensitive menu. • Cancels operation done on the object selected.
Trackball	• Moves the cursor. • Selects an object.
USB port	For connection of USB flash memory (FAT16 or FAT32 format). Do not connect a USB HDD or PC keyboard. The DVD drive (Maker: TEAC, Type: PU-DRV10) is for chart updates.

1.1.3 Processor Unit EC-3000

The Processor Unit is the heart of the chart system, and is mainly responsible for the chart management, route planning and route navigation.

The Processor Unit has two power switches. The Mains switch controls the power from the switchboard, and the Power switch controls the power to the chart radar system.

Note 1: Do not operate the chart radar with a DVD or CD inserted in the DVD drive, to prevent damage to the drive and media. Remove media from the drive after usage. Insert media only to update charts. After completion of an update, remove the media from its drive and store it in its case. Store media out of direct sunlight, in a place where temperature and humidity are moderate and stable

Note 2: To keep the system stable, restart the unit at least once every two weeks.

Note 3: Close the lid of the DVD drive when the drive is not in use.

1.2 How to Turn the System On/Off

Normally, leave the power switches at the front of the Processor Unit on and control the power with the power switch on a Control Unit (RCU-025, RCU-026). The monitor unit is powered independently.

How to power the system

Push the mains switch on the Processor Unit for the "I" position. Turn on the power switch on the Processor Unit or a Control Unit. The start-up display appears on the monitor.

After the power is applied, the program starts up and about one minute later the bearing scale appears. The radar then goes into three minutes of warm-up time to warm the magnetron, which transmits radar pulses. The timer at the center of the screen counts the time remaining for warm-up. When the timer shows 0:00, the indication "ST-BY" appears at the screen center. The radar is now ready to transmit radar pulses. In the stand-by condition, no radar pulses are transmitted and TT nor AIS is active.

The settings on the menus are stored in a non-volatile memory (hard disk) and are preserved when the power is turned off.

Note: If the ambient temperature is less than 0°C (32°F) when the power is applied, nothing appears on the display and the Status LED on the Control Unit flashes. This is because the heater is warming the unit. The display appears in approx. two minutes.

How to power off the system

Press the power switch on the Processor Unit or a Control Unit. Push the Mains switch for the "O" position.

Note: Provided that the radar was once in use with the transmitter tube (magnetron) still warm, you can put the radar in transmit state without three minutes of warm-up. If the Power switch was turned off by mistake or the like and you wish to restart the radar promptly, turn on the Power switch not later than 10 seconds after power-off.

1.3 How to Adjust the Display Brilliance (FURUNO monitor)

The brilliance setting is defined according to the color palette setting. However, manual adjustment of the brilliance is also possible.

Note 1: The brilliance of the FURUNO monitor can only be adjusted from the Control Unit. Use a serial cable for brilliance adjustment to make the connection between the Processor Unit and the Control Unit.

Note 2: Improper brilliance may affect the visibility of information, especially on the night display.

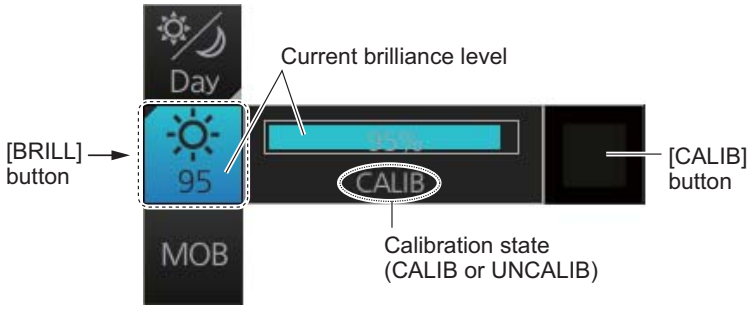
1.3.1 Manual brilliance adjustment

How to adjust the brilliance manually with the BRILL control

Operate the **BRILL** control to adjust brilliance. Turn it clockwise to increase the brilliance; counterclockwise to decrease the brilliance. Watch the brilliance level indication on the [BRILL] button (see the illustration below) to see the current brilliance level.

How to adjust the brilliance manually with the InstantAccess knob

1. Push the **InstantAccess** knob.
2. Rotate the knob to select the [BRILL] button then push the knob to show the brilliance adjustment window.



3. Push the knob, rotate the knob to set the brilliance then push the knob to confirm the setting. The calibration state indication changes to "UNCALIB".
4. Rotate the knob to select the [CALIB] button then push the knob to calibrate the brilliance. The calibration state indication changes to "CALIB".

How to adjust the brilliance manually using the trackball module

1. Click the [BRILL] button on the InstantAccess bar to show the brilliance adjustment window.
2. **For coarse adjustment**, put the cursor on a location within the slider bar area then push the left button. **For fine adjustment**, put the cursor on the end of the slider bar and roll the trackball while holding down the left button.
3. Release the left button to confirm setting. The calibration state indication changes to "UNCALIB".
4. Click the [CALIB] button to calibrate the brilliance. The calibration state indication changes to "CALIB".

1.4 Operating Modes

This chart radar has three operating modes:

- The **radar mode** provides the traditional radar display.
- The **chart radar mode** overlays the electronic chart on the radar image.
- The **chart for radar mode** shows the electronic charts.

1.4.1 How to select an operating mode

Click the [Operating Mode] button to select desired mode from the pull-down list. Select [RADAR] for the radar or chart radar mode (see section 1.5.2), or [CHART for RADAR] for the chart mode.

1.4.2 Limitations when using the chart radar mode

The presentation mode can be course-up RM, north-up RM, or north-up TM. The presentation mode is automatically switched to north-up RM if the mode is head-up at the time the chart radar mode is selected.

1.5 Display Screens

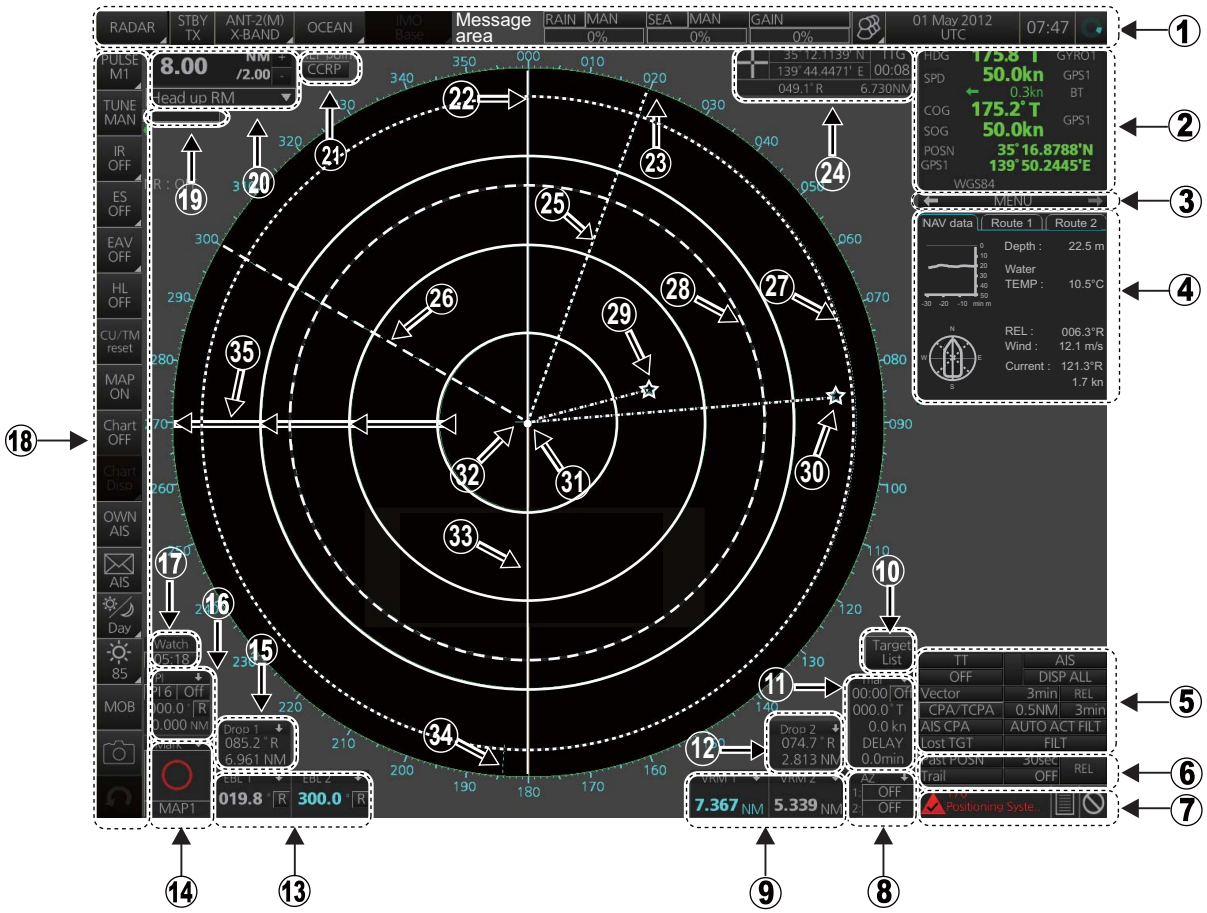
All display screens have operational buttons, boxes and indications, and display markers. Click a button or indication to execute the related operation. Context-sensitive menus are available with several boxes outside the display area and objects inside the display area. Right-click the appropriate box or object to show the related context-sensitive menu.

Monitor viewing distance

The optimal viewing distance for the FURUNO-supplied monitors is 1020 mm.

1.5.1 Radar display

The illustration below shows the markers, data, etc. as they appear on the FURUNO 19-inch monitor unit. The layout for the 23-inch monitor unit is similar.

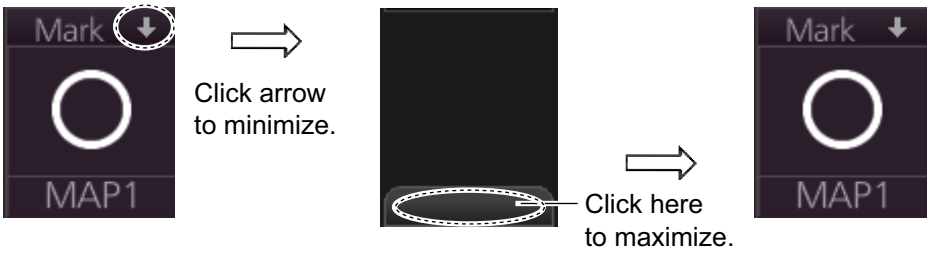


No.	Name	Description
1	Status bar	• Selects an antenna. • Selects the mode. • Adjusts the radar picture. • Displays radar operational messages. See section 1.6.
2	Sensor information box	Shows your ship's heading, heading source, ship's speed, water tracking speed, speed source, course over ground, speed over ground, position source. **Note:** Position source shall meet the requirements of IMO MSC.112(73).

No.	Name	Description
3	Menu	Drop-down menu with various radar and chart functions.
4	Information box	Provides various navigation data and route information.
5	TT/AIS setting box	Sets the parameters for TT and AIS targets.
6	Trail box	Sets the parameters for the target trails.
7	Alert box	Shows alert messages by alert name and alert number. • Unacknowledged or regenerated warning alerts flash in red (alarm) or yellow-orange (warning). • Acknowledged alerts are shown in normal video.
8	Acquisition zone box	Sets an acquisition zone for TT, AIS.
9	VRM boxes	Show the range and TTG to the VRM1, VRM2.
10	Target list button	Displays the TT and AIS target list.
11	Trial maneuver box	Sets the parameters for the trial maneuver.
12	Drop mark 2 box	Shows the bearing and range to the drop mark 2.
13	EBL boxes	Show the bearing to the EBL1, EBL2.
14	Mark box	Selects the mark to inscribe on the radar display.
15	Drop mark1 box	Shows the bearing and range to the drop mark 1.
16	PI line box	• Adjusts the direction and width of the parallel index lines. • Activates or deactivates the parallel index lines.
17	Watch box	Counts down the time remaining until the buzzer sounds to alert the operator to view the radar picture.
18	InstantAccess bar	Quick access to often-used radar, chart radar and chart functions. For radar and chart radar functions, see section 1.7. For chart functions, see section 6.1.3.
19	Tuning bar	Shows tuning status.
20	Range/Presentation mode box	• Selects the radar range. • Selects the presentation mode.
21	REF point box	Selects the reference point (antenna or CCRP) for measurements (range, bearing, etc.) and markers (position, etc.)
22	Heading line	Indicates ship's heading.
23	Bearing scale	The bearing scale provides an estimate of the bearing to a target.
24	Cursor position box	This box shows • Latitude and longitude of the cursor position. • Range and bearing to the cursor position. • TTG to the cursor position.
25	EBL1	Measures the bearing to a target.
26	EBL2	Measures the bearing to a target.
27	VRM1	Measures the range to a target.
28	VRM2	Measures the range to a target.
29	Drop mark 1	Find the range and bearing to drop mark position.
30	Drop mark 2	Find the range and bearing to drop mark position.
31	Antenna marker	A cross marks antenna position.
32	Own ship marker	An inverted “T” marks your ship’s position.
33	Stern marker	Marks location of stern.
34	North marker	Marks North.
35	Range rings	Provide an estimate of the range to a target.

How to minimize, maximize the boxes at the bottom of the screen

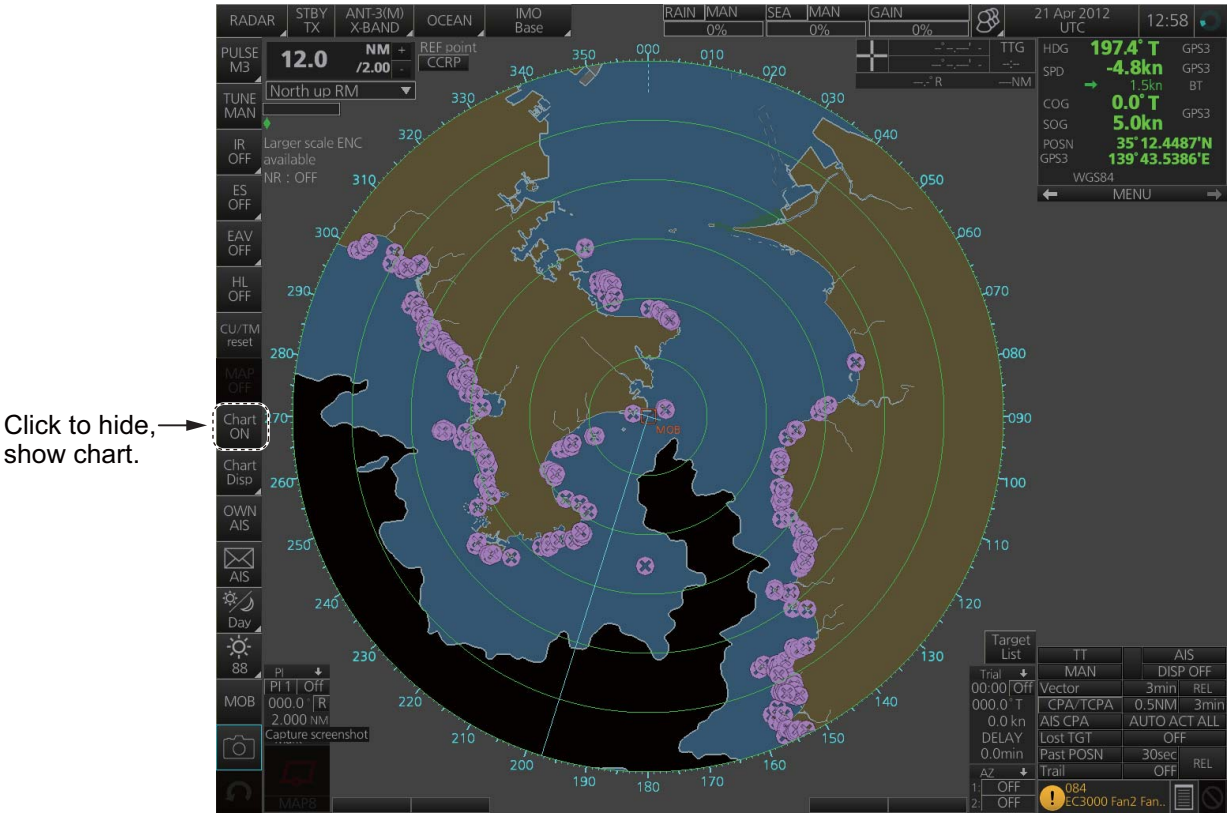
The boxes at the bottom of the screen that contain an arrow can be minimized. Click the arrow to minimize the box. To restore maximum size, click the minimized box.



Note: The respective VRM or EBL is erased from the screen when the corresponding VRM or EBL box is minimized.

1.5.2 Chart radar display

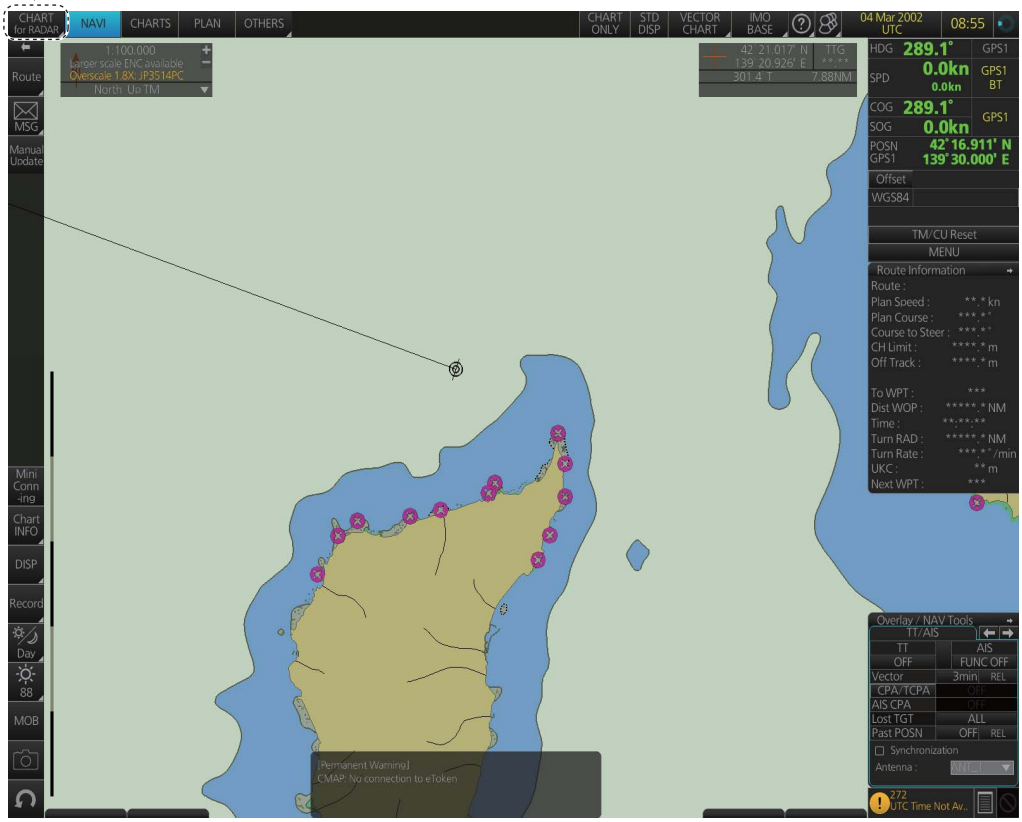
The chart radar display overlays an electronic chart on the radar picture. To switch between the radar and chart radar displays, click the [Chart ON/OFF] button on the InstantAccess bar.



1.5.3 Chart display

The chart display shows only the electronic chart. Click the [Operating Mode] button to select [CHART for RADAR] to activate this display. See Chapter 6 for a description of the chart display.

Select [CHART for RADAR]

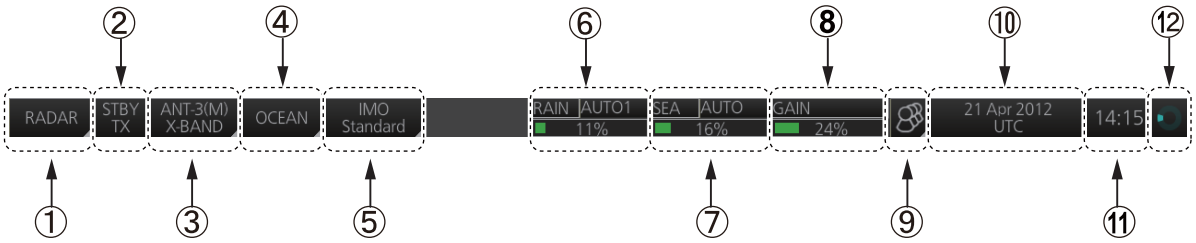


1.6 Status Bar

The Status bar is displayed at the top of screen in all modes. This bar provides, in the radar and chart radar modes, buttons for selection of the mode, antenna and chart database, and adjustment of the radar picture.

For a description of the Status bar used in the chart mode, see section 6.1.2.

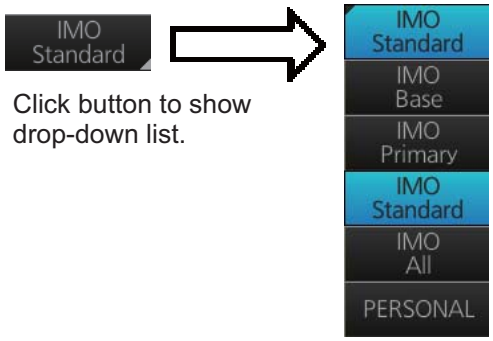
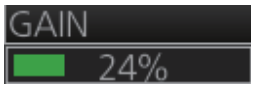
1.6.1 Status bar for radar, chart radar mode



No.	Button name	Description
1	Display Mode	Selects a mode: radar or chart for radar.
2	STBY TX	Toggles the radar between stand-by and transmit.
3	Antenna	Selects an antenna.
4	Picture preset	Presets the radar controls for specific navigation purpose; for example, congested waters.
5	Chart database	Selects the IMO chart database (base, primary, standard or all). Available in the chart radar mode.
6	RAIN	Reduces rain clutter.
7	SEA	Reduces sea clutter.
8	GAIN	Adjusts the gain of the radar receiver.
9	Settings	Manages user profiles; opens the Settings menu.
10	Date	Displays the date and whether the time indication is local or UTC.
11	Time	• Displays the date. • Selects the time to use, local or UTC. • Sets the time difference between local and UTC (to use local time).
12	Spinner	Rotates clockwise if the system is working properly. Picture freeze If the picture freezes, the picture is not updated. After the picture freezes, the buzzer sounds and the Status LED blinks in red. Reset the power to restore normal operation.

1.6.2 How to operate the buttons, slider bars on the Status bar

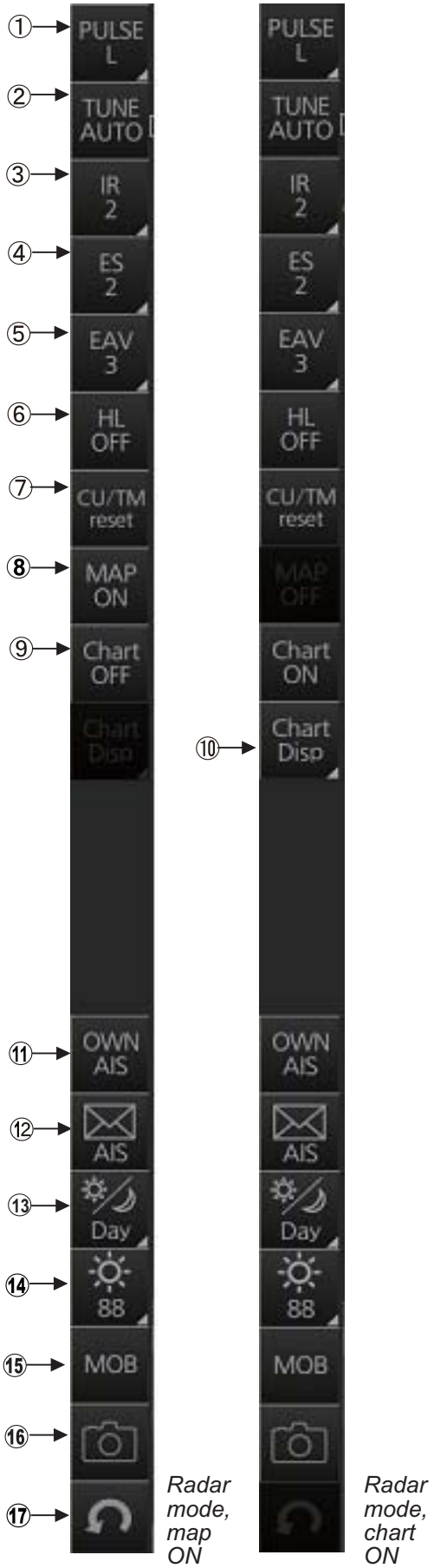
The Status bar has three types of controls: toggle button, drop-down list button and slider bar. You operate the buttons and bars with the trackball module.

Control type	Example of control
Toggle button	
A toggle button alternately selects one of two functions assigned to the button. For example, the [STBY TX] button toggles the radar between stand-by and TX. The background color of the [STBY TX] button momentarily changes to light-blue when switching from standby to TX.	
Drop-down list button	
A drop-down list button provides a list from which to select an option related to the label on the button. A drop-down list button is identified by a triangle on the button's bottom-right corner. The [Chart database] button, shown in the right figure, is an example of a drop-down list button.	
Slider bar	
The slider bars provide for adjustment of the radar picture. [GAIN], [SEA] and [RAIN] are slider bar buttons. To adjust the bar coarsely, put the cursor at any location within the slider bar area then push the left button. For fine adjustment, put the cursor at the end of the slider bar and roll the trackball while holding down the left button. Release the button to finish.	

1.7 InstantAccess Bar

The InstantAccess bar runs vertically along the left edge of the screen and is displayed always. This bar provides, in the radar and chart radar modes, buttons for adjustment of the radar picture and chart, AIS operations, display brilliance control (FURUNO monitor only), MOB, screenshot, etc.

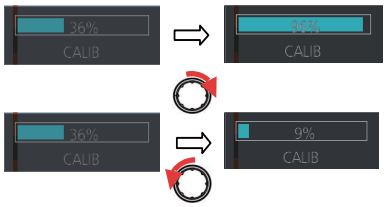
For a description of the InstantAccess bar used in the chart mode, see section 6.1.2.



No.	Button name	Description
1	PULSE	Selects radar pulse length.
2	TUNE	Select the radar receiver tuning method, automatic or manual, and manually tunes the radar receiver.
3	IR	Activates or deactivates the interference rejector.
4	ES	Activates or deactivates the echo stretch.
5	EAV	Activates or deactivates the echo averaging.
6	HL OFF	Temporarily erases everything but radar echoes.
7	CU/TM reset	Resets ship's position in course-up and true motion modes.
8	MAP ON/OFF	Shows or hides the radar map marks on the radar display, in the radar mode.
9	CHART ON/OFF	Shows or hides the electronic chart.
10	Chart Disp	Shows, hides various chart objects. Shown in the chart radar mode. See section 2.37.2.
11	OWN AIS	Shows the [VOYAGE DATA] menu, to set your ships AIS data.
12		Displays screen for “received AIS message.”
13		Selects a color palette.
14		Adjusts the brilliance of a FURUNO monitor.
15	MOB	Enters the MOB mark at the current position.
16		Takes a screenshot.
17		Restore previous condition in radar map and text input.

1.7.1 How to operate the buttons on the InstantAccess bar

The InstantAccess bar has three types of buttons: toggle button, drop-down list button, and slider bar button. (The MOB and Capture buttons are special buttons.) The buttons can be operated with the trackball module or the **InstantAccess** knob. This section shows you how to use the **InstantAccess** knob.

Toggle button	Drop-down list button	Slider bar button
	A drop-down list button provides the functions related to the label on the button. This type of button is identified by the triangle at the bottom-right corner of the button. [Palette] button  *Palette list*	

1. Push the **InstantAccess** knob to enable its use with the InstantAccess bar.
2. Rotate the **InstantAccess** knob to select a button. The background color of the button selected is light-blue.
3. Do one of the following depending on button type.
   1) **Toggle button**: Push the knob to select setting.
   2) **Drop-down list button** or **slider bar**: Rotate the knob to select an item or adjust the slider bar. Push the knob to confirm your selection.
   Note: You can use the **ESC** key to go back one step in the current operating sequence.

1.8 Sensor Information, Datum Box

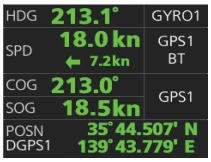
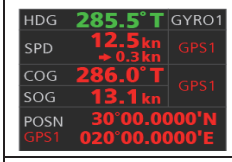
The Sensor, datum information box displays the sensor data and the name of the datum in use. The sensor indications and names are colored according to sensor state. See the table on the next page.

- **HDG**: Heading and its source.
- **SPD**: Longitudinal speed and its source. The direction of transverse speed is indicated with arrows, ▶, Starboard, ◀, Port.
- **COG**: Course over ground and its source.
- **SOG**: Speed over ground and its source.
- **POSN**: Latitude and longitude position of own ship and its source.
- **Datum**: Chart datum (WGS84, WGS72, etc.) in use. No datum appears when there is no datum sentence.

Note: The position source shall meet the requirements of IMO MSC.112(73).

Color of nav data indications and sensor name

The color of the nav data indications and sensor names changes according to the state of the sensor data. The table shown below provides basic indication and color meanings. For detailed information, see Appendix 4. When no sensor data is received, the sensor source indication is blank and the related indication shows asterisks.

Nav data indication	Color of nav data indication	Color of sensor name	State
	Green	White	Sensor is normal.
	Yellow	White	Validity of data is low or offset is applied.
	Red	Red	Validity of data is critically low.
	Green, data shown with asterisks (***.*)	No display	Data is not being received.
	Yellow	Yellow	Data is input manually (dead reckoning).

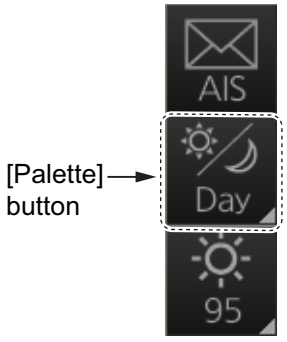
1.9 How to Select a Color Palette

This radar provides three sets of color and brilliance sets (palette), day, dusk and night, to match any ambient lighting condition. The default specifications of each palette are as shown in the table below. The panel dimmer setting is automatically changed, and the number of steps depends on the color palette selected.

Palette	Brilliance		Panel dimmer (step)	Text color	Background color
	19" monitor	23" monitor			
Day-gray	110 cd/m^2	120 cd/m^2	15	White	Gray
Day-blue	110 cd/m^2	120 cd/m^2	15	White	Blue
Dusk-gray	50 cd/m^2	50 cd/m^2	7	Light gray	Dark gray
Dusk-blue	50 cd/m^2	50 cd/m^2	7	Light gray	Dark blue
Night-gray	5 cd/m^2	5 cd/m^2	3	Orange	Dark gray
Night-blue	5 cd/m^2	5 cd/m^2	3	Light gray	Dark blue

To select a palette, do the following:

1. Click the [Palette] button.



2. Click[Day], [Dusk] or [Night] as appropriate. For example, select [Day] to show its options.

3. Click the palette (gray, blue) desired.

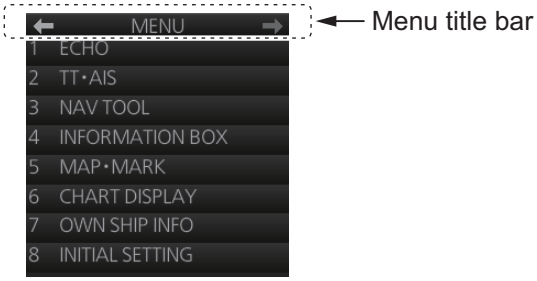
Note: A palette can also be selected by pushing the **BRILL** control on the Control Unit.

1.10 Menu Overview

The menu consists of eight main menus and several sub menus. You can operate the menu with the Radar Control Unit or trackball module. The system closes open menus whenever there is no menu operation for 30 seconds.

1.10.1 Basic menu operation

1. Open the main menu.
   Control Unit: Press the **MENU** key.
   Trackball module: Click the menu title bar at the right side of the display.



2. Select a menu.
   Control Unit: Press the corresponding numeric key. For example, press the **3** key to show the [NAV TOOL] menu.
   Trackball module: Click the menu desired. The current selection is highlighted in green.

3. Select a menu item.
   Control Unit: Press the corresponding numeric key.
   Trackball module: Click the menu item desired. The current selection is highlighted in green.
4. Select a menu option.
   Control Unit: Press the corresponding numeric key. The current selection is highlighted in orange.
   Trackball module: Spin the scrollwheel. The current selection is highlighted in orange.
5. Confirm your selection.
   Control Unit: Press the **ENTER** key.
   Trackball module: Push the left button.

Note: Hereafter, "select" in a menu operating procedure means to press the applicable numeric key on the Control Unit or push the left button on the trackball module.

Keys, buttons to use for navigation in menus

Control Unit

MENU key: Open main menu, or close menu when main menu is displayed.
CANCEL key: Go back one layer in menu, or close menu when main menu is displayed.
←key: Return to main menu, in no. 2 layer or higher.

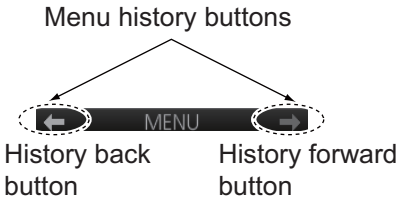
Trackball module

Right button: Go back one layer, or close menu when main menu is displayed.
Left button: (1) Click menu title bar to go back one layer, or close menu when main menu is displayed, (2) Click the left arrow on the menu title bar to return to the main menu, in no.2 layer or higher.

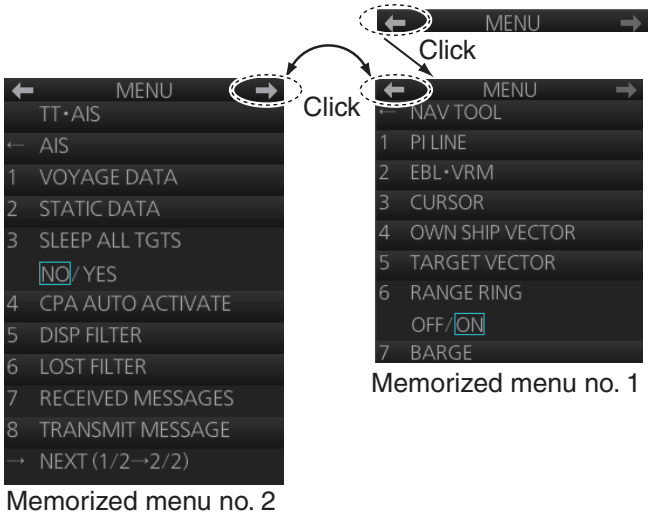
Menu history feature

This chart radar remembers the 10 last-used menus to help you go to recently used menus quickly. The memorized menus are cleared when the power is turned off. Installation- and service-related menus and menus where no operation occurred are not memorized. Menus accessed multiple times are counted as one menu.

Click the memory history buttons on the menu title bar to navigate through the last-used menus.



For example, the last two used menus are [NAV TOOL] and [AIS].



Memorized menu no. 1

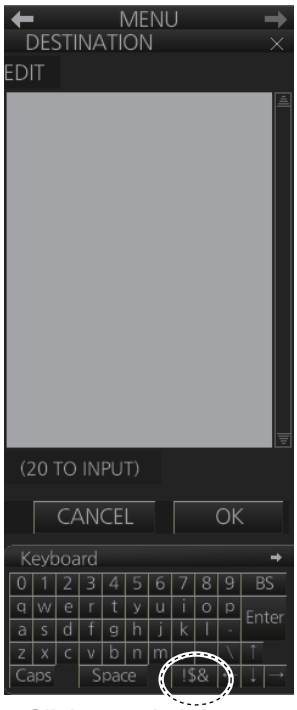
Memorized menu no. 2

1.10.2 How to enter numeric data

Select the numeric data, then do one of the following:
Control Unit: Use the ten keys to enter data.
Trackball module: Spin the scrollwheel to set data then push the left button.

1.10.3 How to enter alphanumeric character data

Some operations display a software keyboard to enter alphanumeric character data.



Click to switch between letters and symbols.

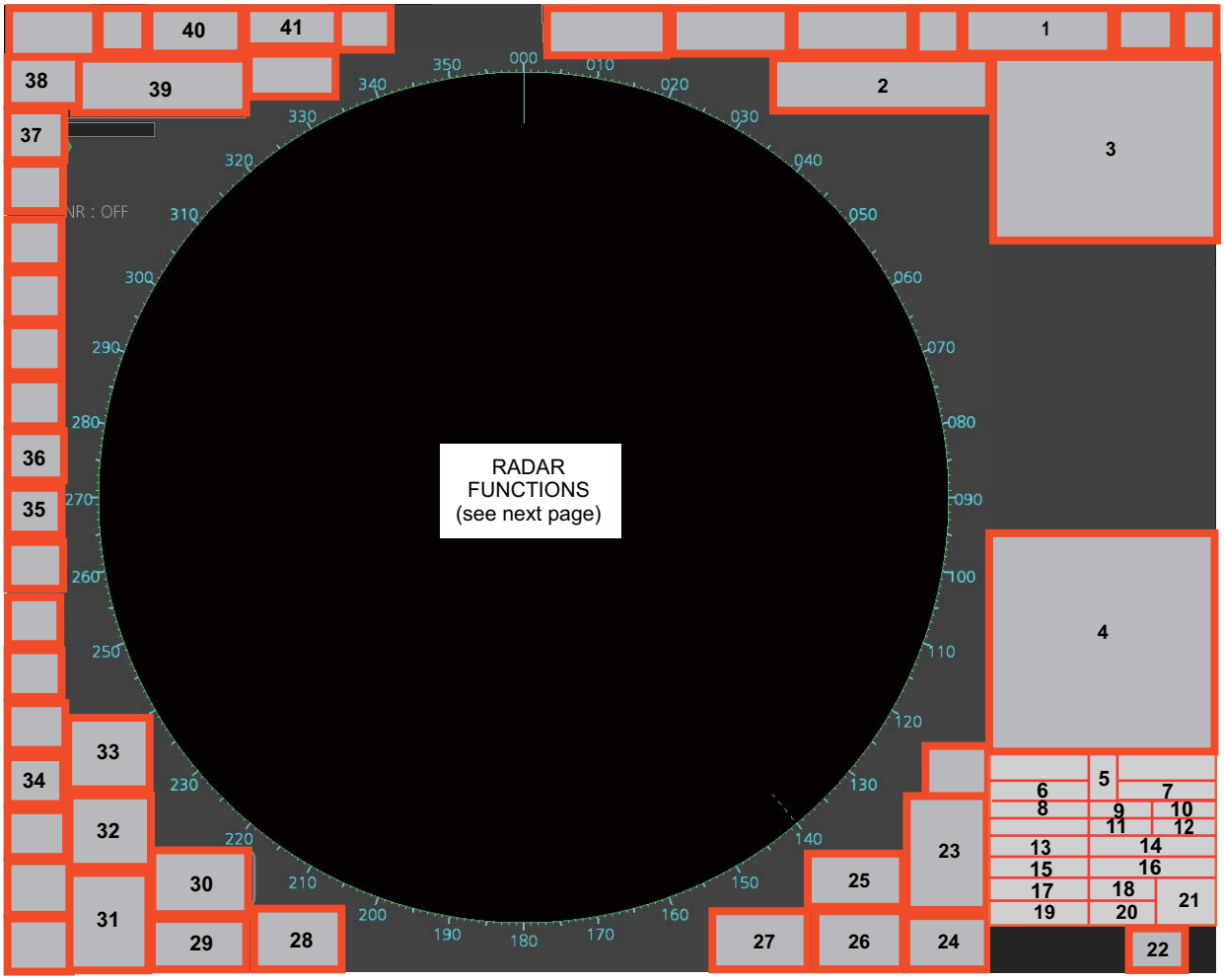
To enter characters, click applicable characters on the software keyboard. You can switch between letter input and symbol input by clicking the key shown in the illustration above:

1.11 Context-Sensitive Menus in the Radar Mode

Context-sensitive menus are available with many of the boxes and buttons surrounding the display area and objects within the display area. Right-click the boxes and buttons marked with numerals in the illustration below to show the related context-sensitive menus. If a menu is not operated within 30 seconds it is automatically closed.

For context-sensitive menus in the chart mode, see the chapter on chart overview.

1.11.1 Context-sensitive menus available with buttons and boxes



No.	Box name	Menu	No.	Box name	Menu
1	Adjust Local Time	Set Local Time	6	TT	TT OFF / MAN / AUTO / MAN/AUTO,TT Menu, Symbol Menu
2	Cursor Position	Range-Bearing Position, X-Y Position, Cursor Menu	7	AIS	DISP OFF / FILT / ALL, AIS Menu, Symbol Menu
3	Sensor Information	Select Sensor, OS INFO Menu	8	Vector	OS Vector Menu, Target Vector Menu
4	AIS Info	Expanded AIS Data, AIS Message	9	Vector Time	Vector Time (30 s - 60 min), OS Vector Menu, Target Vector Menu

No.	Box name	Menu	No.	Box name	Menu
5	Association	Association OFF/ TT/AIS, Association Menu	10	Vector Reference	True-G(S), REL, OS Vector Menu, Target Vector Menu
11	CPA Range	CPA Range (0.5 - 6.0 NM)	27	VRM1	VRM1 OFF, EBL-VRM Menu
12	CPA time	CPA Time (1 - 15 min)	28	EBL2	EBL2 OFF, EBL-VRM Menu
13	AIS CPA	Auto Activate Menu	29	EBL1	EBL1 OFF, EBL-VRM Menu
14	Auto Activate	OFF, AUTO ACT FILT, AUTO ACT ALL, Auto Activate Menu	30	Drop Mark1	Drop 1 Off
15	Lost TGT	TT Lost Filter Menu, AIS Lost Filter Menu	31	Mark	Mark Color (B-type only), Mark Position, MAP File, Edit Map Comment, Map Mark Menu
16	Lost TGT Filter	OFF, FILT, ALL, TT Lost Filter Menu, AIS Lost Filter Menu	32	PI Line	Number of PI Line, Reset PI Line, PI Menu
17	Past POSN	Past POSN Menu	33	Watch	Watch Time (OFF, 6 - 20 min)
18	Past POSN time	Past POSN Time (OFF, 30 s - 6 min)Past POSN Menu	34	Brill Menu	Brill Menu
19	Trail	Trail All Clear, Trail Menu	35	Chart ON/OFF	Chart Display Menu
20	Trail Time	Past POSN Time (OFF, 30 s - 6 min), Past POSN Menu	36	MAP ON/OFF	Radar Map Menu, Route Menu, Event Menu, User Chart Menu
21	Trail/Past POSN Reference	True-G(S), REL, Past POSN Menu, Trail Menu	37	TUNE	Tune Initialize
22	Alert List	Alert List/Log Win-dow	38	PULSE	Pulse Menu
23	Trial	Trial Mode, Trial Maneuver Menu	39	RANGE	Range Scales (0.125 - 96 NM)
24	AZ	Acquisition Zone Menu	40	Antenna Selection	ANT Select Menu
25	Drop Mark2	Drop 2 Off	41	Customize Echo	Customize Echo Menu
26	VRM2	VRM2 OFF, EBL-VRM Menu			

1.11.2 Context-sensitive menus in the display area in the radar and chart radar modes

Right-click anywhere in the display area in the radar and chart radar modes to show the context-sensitive menu.

Radar mode, map ON

Radar mode, map OFF or chart ON

Radar mode, map ON, area selected

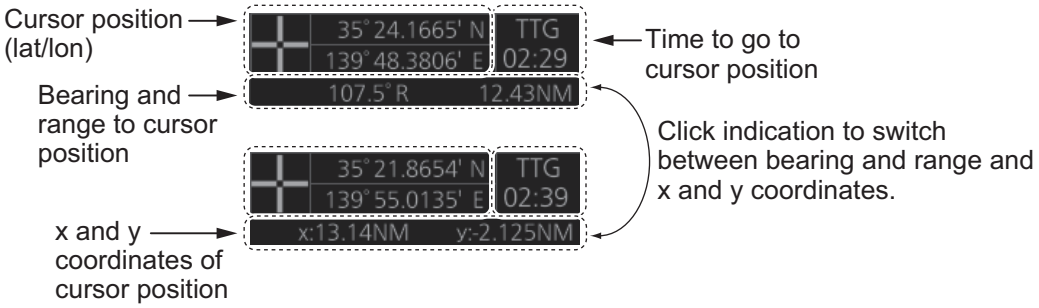
Target Data/ACQ/ACT: For cursor-selected TT or AIS target, display target data, acquire target for TT, or activate sleeping AIS target.
Target Cancel: Cancel tracking on selected tracked target (erase target), sleep activated AIS target.
Off Center: Off center the display.
EBL Offset: Offset EBL1, EBL2 (to measure range and bearing between two targets).
Zoom Set: Select zoom area.
Area Select: Specify the area where to delete, copy marks.
Mark Delete: Delete cursor-selected mark. Greyed out when radar map is off.
Mark Copy: Copy cursor-selected mark. Greyed out when radar map is off.
Own Ship Offset: Apply an offset to own ship position.
REF Mark: Make cursor-selected target a reference target (for use in TT). Greyed out unless TT is active.
Cursor Size: Select cursor size, large or small.
Notes Detail: Show details about cursor-selected Notes.
MOB Delete: Delete selected MOB mark.

Area selected

This context-sensitive menu is available when an area is created to cancel tracking on specific targets, or delete or copy marks.
Area Target Cancel: Cancel tracking on targets within the area selected.
Area Mark Delete: Delete all marks within the area selected.
Area Mark Copy: Copy all marks within the area selected.
Area Cancel: Cancel the area created.

1.12 Cursor Position

Cursor data appears in the Cursor position box at the top-right position on the display. The appearance of the box is slightly different between the 23-inch and 19-inch displays, although the content is the same.



The indication below the cursor position can show the range and bearing to the cursor or x-y coordinates of the cursor position. Click that indication and select [Range-Bearing position] or [x-y position] as appropriate. For the X-Y coordinate display, the Y-axis is the heading line, right/top is "plus" and left/lower is "minus".

Note 1: The cursor bearing can be selected to true or relative with [1 CURSOR BEARING] in the [CURSOR] menu. Right-click the indication and select [Cursor Menu] to open the [CURSOR] menu.

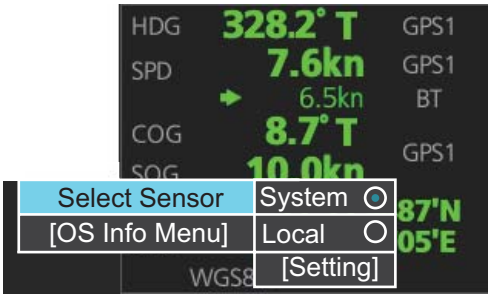
Note 2: The cursor position is shown as "---.-" when the cursor is not within the effective display area.

Note 3: For the Cursor position box that appears in the Chart mode, see section 6.6.

1.13 How to Select Sensor Settings

This radar system accepts navigation data input two ways: System or Local. System shares sensor data among multiple radars in a network. Sensor priority is also commonly shared among the radars. Local selects a sensor outside the network.

1. Right-click anywhere in the Sensor information box to show the context-sensitive menu.

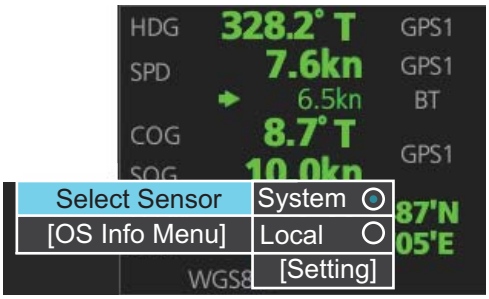


2. Click [Local] or [System] as applicable.
   Note: The sensor system can also be selected in the chart mode through this procedure and through the menu. Open the menu then select [7 OWN SHIP INFO] followed by [1 SENSOR].

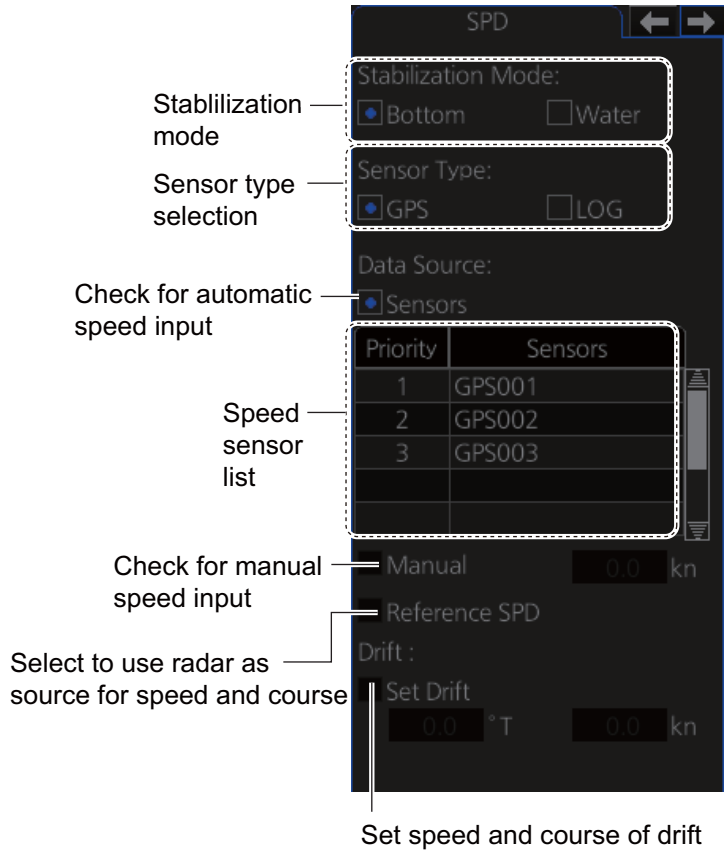
1.14 How to Enter Ship Speed

The TT and azimuth stabilized presentation modes require own ship speed input and compass signal. The speed can be entered automatically from a speed log (STW, SOG) or GPS (SOG), or manually on the menu. Note that the FURUNO GPS Navigator GP-150 provides COG and SOG.

1. Right-click anywhere in the Sensor information box to show the context-sensitive menu.



2. Click [Select Sensor] then click [Setting].
3. Use the arrow buttons to select the [SPD] page.



SPD page

4. **For automatic input**, follow the procedure below. **For manual input**, go to step 5.
   1) Check [Sensors].
   2) Set the priority for the speed sensors in case of Local sensor. Click the triangle on any line then select the sensor to set as the primary source of speed. All other sensors are then set as secondary source. Only one sensor can be pri-

mary while the others can be secondary. If a speed sensor is changed from secondary to primary state and another speed sensor was selected as primary, then that sensor previously selected to primary state is then automatically selected to secondary state.

3) Select [Bottom] or [Water] at [Stabilization Mode] to set the stabilization method. Select [Bottom] for GPS or [Water] for a speed log.
4) Check [LOG] or [GPS] at [Sensor Type] to select the source of speed data.
5) Go to step 6.

5. **For manual input**, set the stabilization mode for [Water] and check [Manual]. Click the manual box to show the up and down arrows then click appropriate arrow to set speed.
   Note: For set and drift, see chapter 16.
6. Click the [OK] button to save the settings then click the [MENU] bar to close the menu.

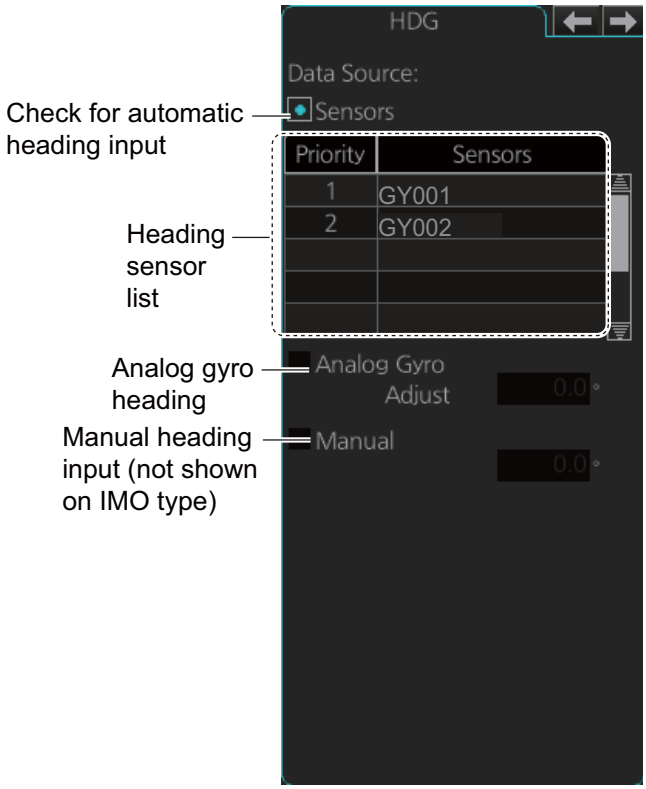
Notes on speed input

- IMO Resolution A.823(19) for TT requires that a speed log to be interfaced with a TT should be capable of providing through-the-water speed (forward speed).
- A single-axis water log cannot measure speed when the wind is coming from the leeway direction.
- When AIS is active, "Manual", "Reference SPD" and "Set Drift" are shown in gray to indicate that they are not available for selection.

1.15 How to Enter Heading

Choose manual or automatic heading input as follows:

1. Right-click anywhere in the Sensor information box to show the context-sensitive menu.
2. Click [Select Sensor] then click [Setting].
3. Use the arrow buttons to select the [HDG] page.

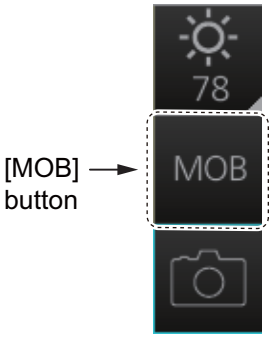


HDG page

4. **For automatic input**, follow the procedure below. **For manual input**, go to step 5.
   1) Check [Sensors].
   2) Set the priority for the heading sensors. Click the triangle on any line then select the sensor to set as the primary source of heading. All other sensors are then set as secondary source. Only one sensor can be primary while the others can be secondary. If a heading sensor is changed from secondary to primary state and another heading sensor was selected as primary, then that sensor previously selected to primary state is then automatically selected to secondary state.
   3) Go to step 6.
5. **For manual input**, check the [Manual] box. Click the heading input box to show the up and down arrows. Click the arrows to set heading.
6. Click the [OK] button to save the settings then click the [MENU] bar to close the menu.

1.16 How to Mark MOB Position

Use the MOB (man overboard) feature to mark the position of man overboard on the display screen. Click the [MOB] button (in any mode) on the InstantAccess bar.



The MOB mark instantly appears at the geographical position of your ship when the button is clicked.

Up to 100 MOB marks can be saved. When the capacity for MOB marks is reached, the oldest mark is automatically erased to make room for the latest.

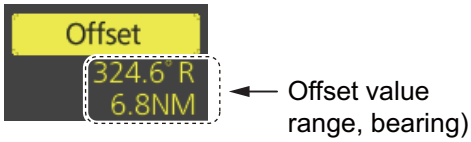
To delete an MOB mark, right-click the mark to show the context-sensitive menu then select [MOB Delete].

Exercise caution when using this feature in strong tide or current. The person will not be at the MOB position for a very long time.

1.17 How to Offset Position

The position shown in the Sensor information box may be different from the actual position. This error affects the positioning accuracy of radar echoes, radar map and TT and AIS symbols. If there is a difference, apply an offset to position as shown below to compensate for the error.

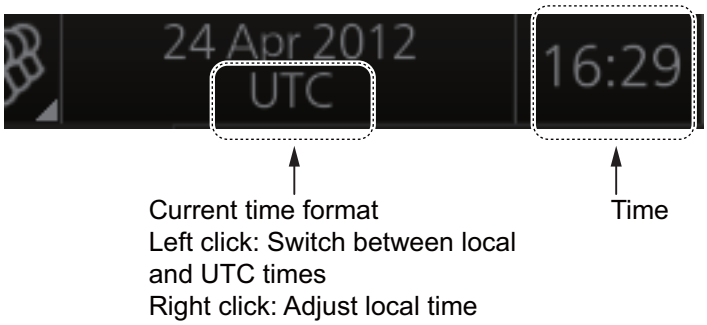
1. Right-click the display area to show the context-sensitive menu.
2. Select [Own Ship Offset] and push the left button. The color of the cursor becomes blue.
3. Roll the trackball until the cursor is at the "correct position".
4. Push the left button to confirm.



To cancel the offset, show the context-sensitive menu then select [Reset Own Ship Offset]. The indication [Offset] and the offset values are then erased from the display.

1.18 How to Select Time Format, Set Local Time

The GPS navigator feeds time and date data to the chart radar and they appear on the Status bar. Neither the time nor the date can be adjusted, however you can select between UTC time (default) and local time. You can switch between the local time and the UTC time by left-clicking the Current time format indication.



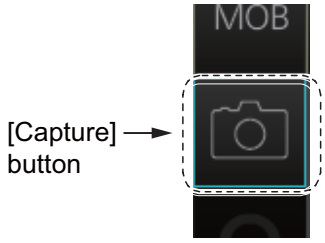
To use the local time, enter the time difference between the local time and the UTC time as shown below.

1. Right-click the Current time format indication to show the context-sensitive menu then click [Set Local Time] to display the [Adjust Local Time] dialog box.

2. Enter the time difference between the local time and the UTC time, in hours and minutes. Use the button on the left to select the time offset direction. Select "+" if the local time is ahead of the UTC time, or "-" if it is behind the UTC time.

1.19 How to Take a Screenshot of the Display

Click the [Capture] button on the InstantAccess bar to take a screenshot and save it to the SSD (Solid State Drive). You can save a maximum of 100 screenshots. When the memory for screenshots becomes full, you cannot take any more screenshots. In this case, delete unnecessary screenshots. You cannot take a screenshot when a menu or a dialog box is opened.



Screenshots can be copied to a USB flash memory. For how to process screenshots, see section 23.9.

1.20 The Settings Menu

The [Settings] button gives you access to the user profiles and the [Settings] menu. The [Settings] menu has facilities for screenshot management, file management, diagnostic tests and customizing. See chapter 23.

1.21 User Profiles for Radar, Chart Radar

The [Settings] button lets you store ten sets of custom settings for brilliance settings and color settings (echoes, TT and AIS symbols and echo trails). This allows individual users to quickly set the system according to their preferences.

1.21.1 How to create a profile

1. Set the color settings (echoes, TT and AIS symbols, echo trail) as desired.
2. Click [ ] on the Status bar then click [Manage Profile].
3. Select a profile number from the “Profile” drop-down list.
   Note: Profiles 06-10 are disabled in the default setting. To enable a disabled profile, select the profile to enable from the “Profile” drop-down list then uncheck [Disable this profile].
4. Click [Save Current Settings].

1.21.2 How to disable a profile

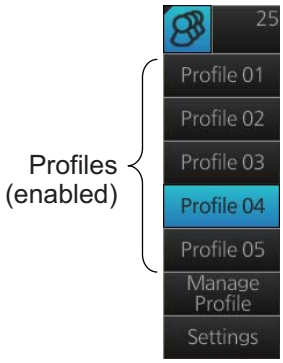
Select the profile to disable from the “Profile” drop-down list then check [Disable this profile]. Profile 01 cannot be disabled.

1.21.3 How to restore default settings to a profile

Select the applicable profile from the “Profile” drop-down list then click [Restore Default Settings].

1.21.4 How to activate a profile

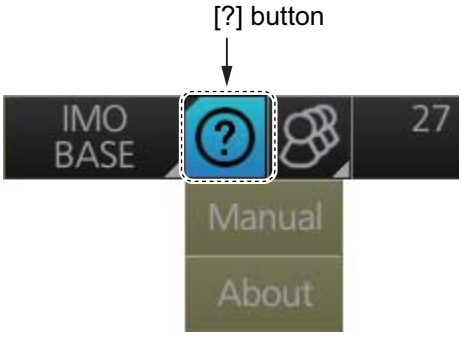
1. Click [ ] on the Status bar.
2. Click the profile number to activate.



1.22 How to View Chart Software Version No., Chart System Information, and Operator's Manual

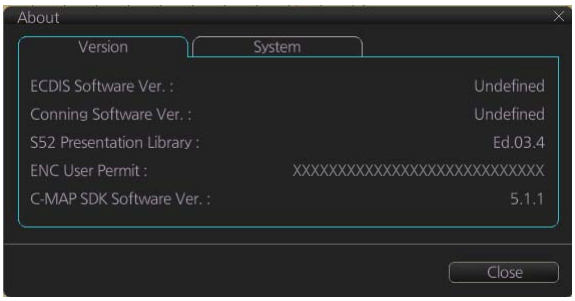
You can show chart (ECDIS) program no., chart system information, and the operator's manual as follows:.

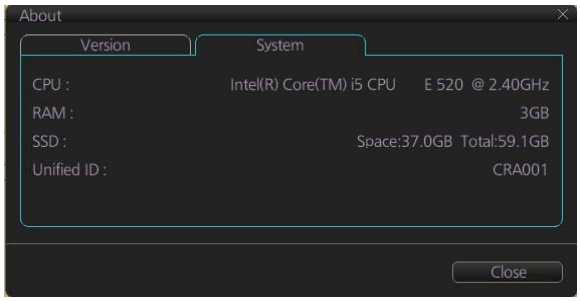
1. Click the [Operating Mode] button at the left end of the Status bar to select [Chart for Radar].
2. Click the [?] button on the Status bar.



3. Select [Manual] to show the operator's manual, or [About] to show chart and system information.

On the [About] screen, click the [Version] tab to show the chart (ECDIS) software version no., conning software version no., S52 presentation library version, ENC user permit no., and C-MAP SDK software version no. Click the [System] tab to show system information: CPU type, RAM capacity, SSD free/SSD capacity and Unified ID. The numbers you see may be different from those in the illustration below.





1.23 Tips (operational guidance)

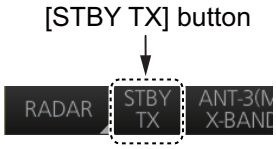
This chart radar provides operational tips for the display area, InstantAccess bar and Mark box. To get a tip, simply put the cursor on the object. For example, put the cursor on the [Capture] button on the InstantAccess bar. The tip "Capture screenshot" appears.

If you do not need the tips, you can turn them off with [TIPS GUIDANCE] in the [INITIAL SETTING] menu.

2. RADAR, CHART RADAR OPERATION

2.1 How to Transmit

After the power is turned on and the magnetron has warmed, "ST-BY" appears at the screen center, meaning the radar is ready to transmit radar pulses. You can transmit by pushing the **STBY/TX** key on the Control Unit, or clicking the [STBY TX] button on the Status bar.

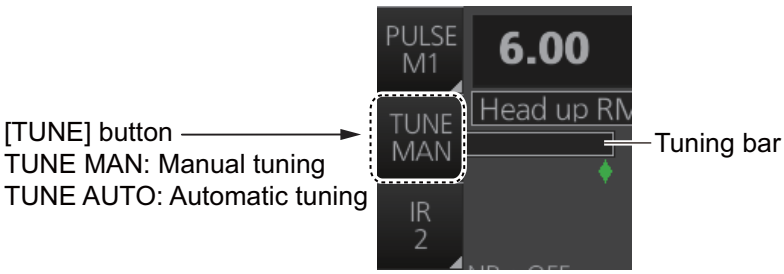


The radar is initially set to previously used range and pulse length. Other settings such as brilliance levels, VRMs, EBLs and menu option selections are also set to previous settings.

The **STBY/TX** key (or [STBY TX] button) toggles the radar between STBY and TRANSMIT state. The antenna is stopped in stand-by and rotates in transmit. Set the radar in standby when its use is not required, to conserve the life of the magnetron.

2.2 How to Tune the Radar Receiver

After the radar is transmitting, adjust the receiver to the exact frequency of the transmitter, automatically or manually. The current tuning method and tuning status is shown at the top-left position.



2.2.1 How to initialize tuning

Automatic tuning is initialized during the installation. However, if you feel that automatic tuning is not working properly try re-initializing the tuning. Right-click the [TUNE] button then select [Tune initialize] to start the initialization.

2.2.2 Automatic tuning

Click the [TUNE] button on the InstantAccess bar to display [TUNE AUTO].

2.2.3 Manual tuning

To tune the radar, start by setting the brilliance to a comfortable level, adjusting the gain until the background speckle just disappears, and selecting the 48-mile range. Then, do the following:

1. Choose a weak contact somewhere near the edge of the screen and concentrate on that, while adjusting the gain control in small steps - allowing at least two seconds between each step - until the chosen contact is as big, bright and consistent as possible.
2. Click the [TUNE] button on the InstantAccess bar to display [TUNE MAN].
3. Put the cursor on the tuning bar.
4. Spin the scrollwheel to tune. The best tuning point is where the bar swings maximum. The arrow below the bar shows the tuning control position; not the tuning condition.

2.3 Presentation Modes

This radar has the following presentation modes in the radar mode:

Relative Motion (RM)

Head-up: Unstabilized.
Head-up TB: Head-up with compass-stabilized bearing scale (True Bearing) where the bearing scale rotates with the compass reading.
Course-up: Compass-stabilized relative to ship's orientation at the time of selecting course-up.
North-up: Compass-stabilized with reference to North.

True Motion (TM)

North-up: Ground- or sea-stabilized with compass and speed inputs.

Mode availability

Presentation mode	Availability	
	Radar	Chart radar
Course-up	Yes	Yes
Head-up RM	Yes	No
Head-up TB RM	Yes	No
North-up RM	Yes	Yes
North-up TM	Yes	Yes
Stern-up*	Yes	No

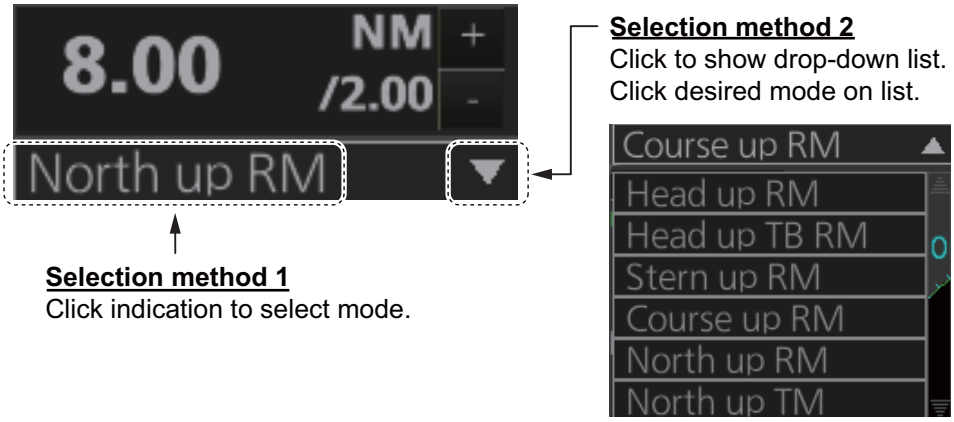
*Not available with IMO or A type.

2.3.1 How to select a presentation mode

How to select a presentation mode from the Control Unit

Push the **MODE** key consecutively to select radar presentation mode desired. The Range/Presentation mode box shows the current presentation mode.

How to select a presentation mode from the Range/Presentation mode box



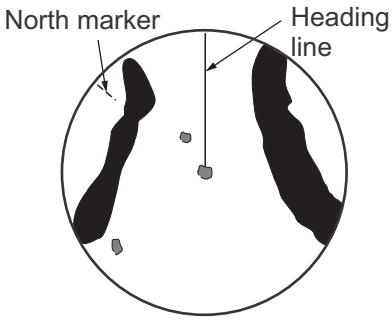
IMPORTANT

Loss of gyrocompass signal

When the gyrocompass signal is lost, the Alert "Gyro xxx COM1 Error" (xxx=a number between 250 and 259 according to gyro no.) appears in the [Alert] box. After all signals are lost, the Alert 450 "Heading Sensor Not Available" appears, the presentation mode becomes head-up and all TT and AIS are erased. Check the gyrocompass and select the presentation mode with the **MODE** key or the Range/Presentation mode box.

2.3.2 Description of presentation modes

Head-up mode

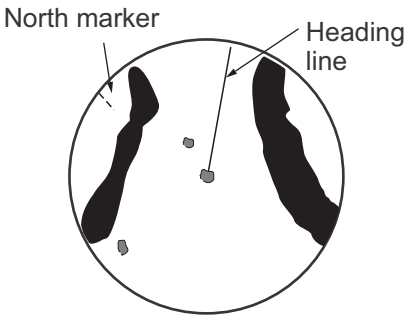


The head-up mode is a display in which the line connecting own ship and the top of the display indicates own ship's heading.

The target pips are painted at their measured distances and in their directions relative to own ship's heading.

The short line on the bearing scale is the north marker, which indicates heading sensor north. A failure of all the heading sensor inputs will cause the heading readout to disappear, and the Alert 450 "Heading Sensor Not Available" or "Gyro xxx COM1 Error" (a number between 250-259 according to gyro no.) appears in the [Alert] box.

Course-up mode



The course-up mode is an azimuth stabilized display in which a line connecting the center with the top of the display indicates own ship's intended course (namely, own ship's previous heading just before this mode has been selected).

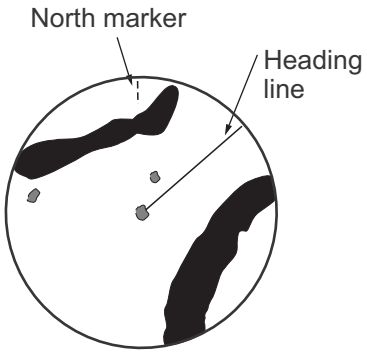
Target pips are painted at their measured distances and in their directions relative to the intended course, which is maintained at the 0-degree position. The heading line moves in accordance with ship's yawing and course change. This mode is useful for avoiding smearing of the picture during course change.

Head-up TB (True Bearing) mode

Radar echoes are shown in the same way as in the head-up mode. The difference from the normal head-up presentation lies in the orientation of the bearing scale. The bearing scale is heading sensor stabilized. That is, it rotates in accordance with the heading sensor signal, enabling you to know own ship's heading at a glance.

This mode is available when the radar is interfaced with a gyro heading sensor. If the gyro heading sensor fails, the bearing scale returns to the state of head-up mode.

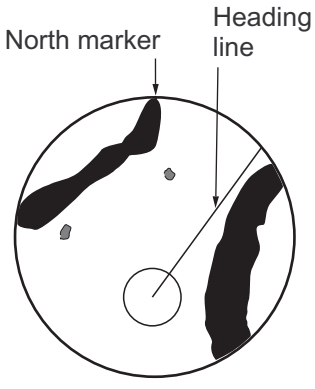
North-up mode



The north-up mode paints target pips at their measured distances and in their true (heading sensor) directions from own ship, north bearing maintained at the top of the screen. The heading line changes its direction according to the ship's heading. Requires heading signal.

If the compass fails, the presentation mode changes to head-up and the north marker disappears. A failure of the heading sensor input will cause the heading readout to disappear, and the Alert 450 "Heading Sensor Not Available" or "Gyro COM1 Error" (a number between 250-259 according to gyro no.) appears in the [Alert] box.

True motion mode

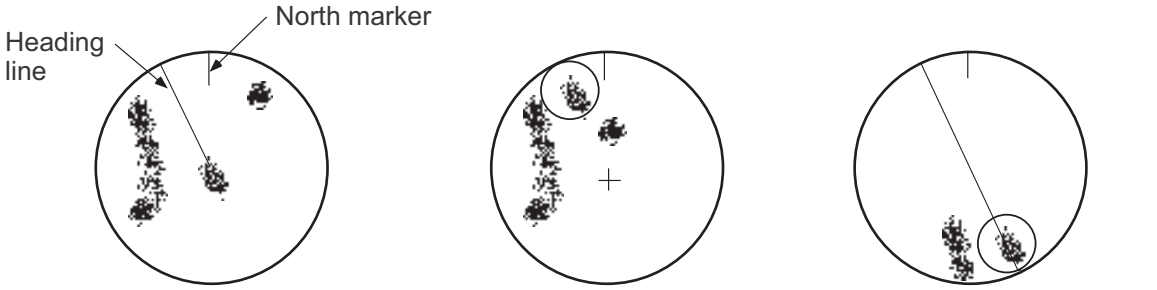


Own ship and other moving objects move in accordance with their true courses and speed. In ground stabilized TM, all fixed targets, such as landmasses, appear as stationary echoes. In the sea stabilized TM without set and drift inputs, the landmass can move on the screen. Note that true motion is not available on the 96 nm or higher range scale range scale. If COG and SOG (both over the ground) are not available on the TM mode, enter the set (tide direction) and drift (tide speed) manually referring to a Tide Table.

If the position of the CCRP results in a part of the bearing scale not being distinguishable, that part of the bearing scale is indicated with appropriate reduced detail.

A failure of the heading sensor input will cause the heading readout to disappear, and the Alert 450 "Heading Sensor Not Available" or "Gyro COM1 Error" (a number between 250-259 according to gyro no.) appears in the [Alert] box.

When own ship reaches a point corresponding to 50% of the radius of the display, own ship position is automatically reset to a point of 75% radius opposite to the extension of the heading line passing through the display center. You can also reset the own ship symbol manually by pushing the **CU/TM RESET** key, or click the [CU/TM reset] button on the InstantAccess bar.



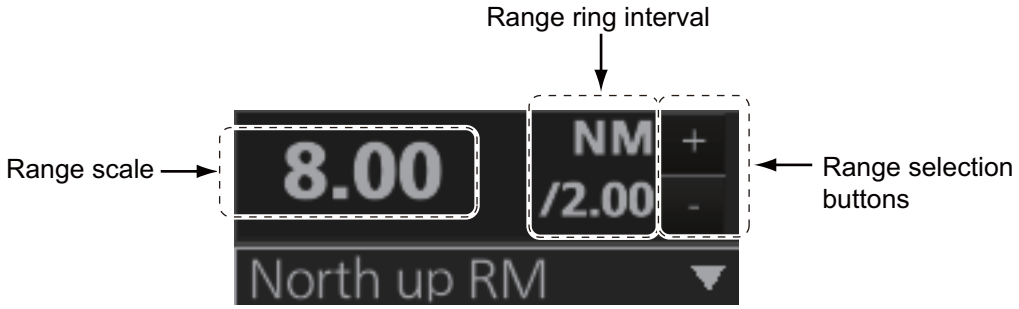
(a) True motion is selected

(b) Own ship has reached a point 50% of display radius

(c) Own ship is automatically reset to 75% of display radius

2.4 How to Select the Range Scale

The selected range scale, range ring interval and pulse length are shown at the top-left position on the screen. When a target of interest comes closer, reduce the range scale so that it appears in 50-90% of the display radius.



Note: The IMO- and A-type radars do not have the 1 nm, 2 nm, 4 nm, 8 nm, 16 nm, 32 nm and 120 nm ranges.

How to select a range scale from the Control Unit

Use the **RANGE** key to select range desired. Hit the "+" part of the key to raise the range; the "-" part to lower the range.

How to select a range scale from the Range/Presentation mode box

Method 1: Click the range scale indication.
Method 2: Click the appropriate range selection button. Click the "+" button to raise the range; the "-" button to lower the range.
Method 3: Right-click the range scale indication to show a drop-down list of available ranges then click a range.

2.5 Pulse Length

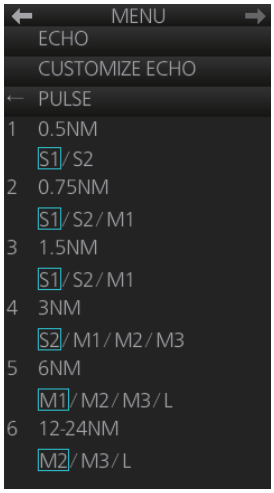
The pulse length in use is displayed at the top-left position on the screen, using the indications shown in the table below.

Pulse length indication	Meaning	Pulse length (μs)
L	Long pulse	1.2
M1	Medium pulse 1	0.3
M2	Medium pulse 2	0.5
M3	Medium pulse 3	0.7
S1	Short pulse 1	0.07
S2	Short pulse 2	0.15

Appropriate pulse lengths are preset to individual range scales and function keys. If you are not satisfied with the current pulse length settings, you can change them as shown below.

2.5.1 How to select a pulse length

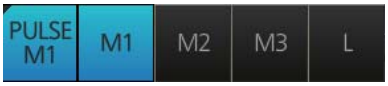
You can select the pulse length for the 0.5 to 24 nm range scales as shown below.



1. Open the menu then select [1 ECHO], [1 CUSTOMIZE ECHO] and [8 PULSE] menus to show the [PULSE] menu.
2. Do one of the following:
   Control Unit: Press appropriate numeric key to select corresponding item number.
   Trackball module: Click appropriate item.
3. Select desired option by pressing the numeric key pressed at step 2 or spinning the scrollwheel.
4. To confirm selection, press the **ENTER** key on the Control Unit, or push the left button.

2.5.2 How to change the pulse length

1. Click the [Pulse] button at the top of the InstantAccess bar.



2. Click a pulse length.

2.6 How to Adjust the Sensitivity

The **GAIN** control (or [Gain] button) adjusts the sensitivity of the receiver. The proper setting is such that the background noise is just visible on the screen. If you set up for too little sensitivity, weak echoes may be missed. On the other hand excessive sensitivity yields too much background noise; strong targets may be missed because of the poor contrast between desired echoes and the background noise on the display.

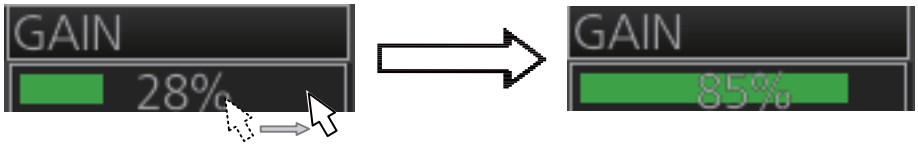
Adjust the gain so background noise is just visible on the screen.

How to adjust the sensitivity from the Control Unit

While monitoring the radar image and the gain slider bar, operate the **GAIN** control to adjust the sensitivity.

How to adjust the sensitivity from the trackball module

For coarse adjustment, put the cursor within the slider bar area then push the left button. **For fine adjustment**, put the cursor at the end of the slider bar then roll the trackball while pushing and holding down the left button. Release the button to finish.



Put cursor on slider bar and push and hold left button. Drag cursor to new location then release left button.

2.7 How to Suppress Sea Clutter

Echoes from waves cover the central part of the display with random signals known as sea clutter. The higher the waves, and the higher the antenna above the water, the further the clutter will extend. When sea clutter masks the picture, suppress it with the **A/C SEA** control (or [SEA] on the Status bar), either manually or automatically.

When both sea clutter and rain clutter are reduced, the sensitivity is decreased more than when only one is adjusted. For that reason adjust them carefully.

The echo average is useful for reducing reflections from the sea surface. However, high-speed targets are harder to detect than stationary ones when the echo average is active.

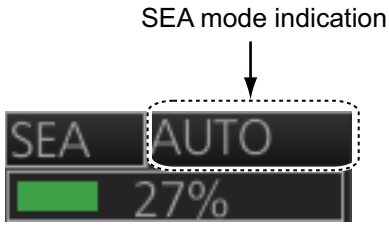
2.7.1 How to reduce sea clutter automatically

Auto A/C SEA allows for fine-tuning of the A/C SEA circuit, within ±20 dB. Accordingly, with the bar reading set to 100, gain is not lowered to minimum as with manual A/C SEA on close-in ranges. Further, the auto A/C SEA level is low because the average value of the original input echo is low in areas where there are no sea surface reflections. For example, when the ship is alongside a quay and the radar picture shows echoes from both land and sea, you can observe the size of echoes because the STC curve is different depending size of echoes.

To get automatic adjustment of sea clutter, do one of the following:

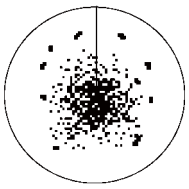
Control Unit: Push the **A/C SEA** control to display [AUTO] on the [SEA] mode indication on the Status bar.

Trackball module: Click the [SEA] mode indication to display [AUTO].

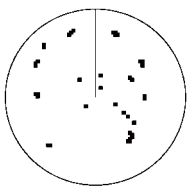


2.7.2 How to reduce sea clutter manually

The **A/C SEA** control reduces the amplification of echoes at short ranges (where clutter is the greatest) and progressively increases amplification as the range increases, so amplification will be normal at those ranges where there is no sea clutter.



Sea clutter at screen center



A/C SEA adjusted; sea clutter suppressed

The proper setting of the A/C SEA should be such that the clutter is broken up into small dots, and small targets become distinguishable. If the setting is set too low, targets will be hidden in the clutter, while if the setting is too high, both sea clutter and targets will disappear from the display. In most cases adjust the control until clutter has disappeared to leeward, but a little is still visible windward.

Be careful not to remove all sea clutter, because you may erase weak echoes. Further, the possibility of losing weak echoes is greater when you use both A/C SEA and A/C RAIN to reduce clutter.

To reduce sea clutter manually, do one of the following:

Control Unit: Push the **A/C SEA** control to display [MAN] on the [SEA] mode indication on the Status bar. Rotate the **A/C SEA** control to adjust the sea clutter.

Trackball module: Click the [SEA] mode indication on the Status bar to display [MAN]. For coarse adjustment, put the cursor within the slider bar area then push the left button. For fine adjustment, put the cursor at the end of the slider bar then roll the trackball while pushing and holding down the left button. Release the button to finish.

2.8 How to Suppress Rain Clutter

The vertical beam width of the antenna is designed to see surface targets even when the ship is rolling. However, by this design the unit will also detect rain clutter (rain, snow, or hail) in the same manner as normal targets.

The **A/C RAIN** control adjusts the receiver sensitivity as the **A/C SEA** control does but rather in a longer time period (longer range). The higher the setting, the greater the anti-clutter effect. When echoes from precipitation mask solid targets, adjust the **A/C RAIN** control to split up these unwanted echoes into a speckled pattern, making recognition of solid targets easier.

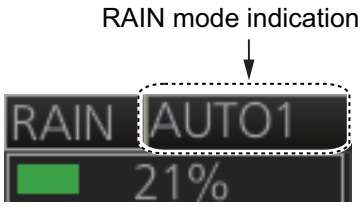
Be careful not to remove all rain clutter, because you can erase weak echoes. Further, the possibility of losing weak echoes is greater when you use both A/C RAIN and A/C SEA to reduce clutter.

Note 1: When both sea clutter and rain clutter are reduced the sensitivity is decreased more than when only one is adjusted. For that reason adjust them carefully.

Note 2: The echo average (see 2.16) is useful for reducing reflections from the sea surface. However, high-speed targets are harder to detect than stationary ones when the echo average is active.

2.8.1 How to reduce rain clutter automatically

Control Unit: Push the **RAIN** control to display [AUTO1], [AUTO2], [AUTO3] or [AUTO4] on RAIN mode indication on the Status bar. The higher the number the greater the degree of rain clutter reduction.



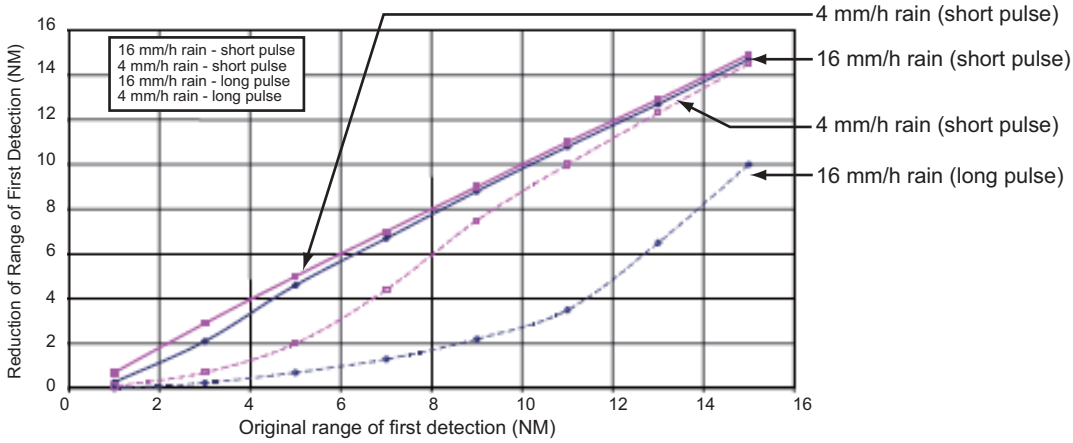
Trackball module: Click the [RAIN] mode indication on the Status bar to display [AUTO1], [AUTO2], [AUTO3] or [AUTO4]. The higher the number the greater the degree of rain clutter reduction.

2.8.2 How to reduce rain clutter manually

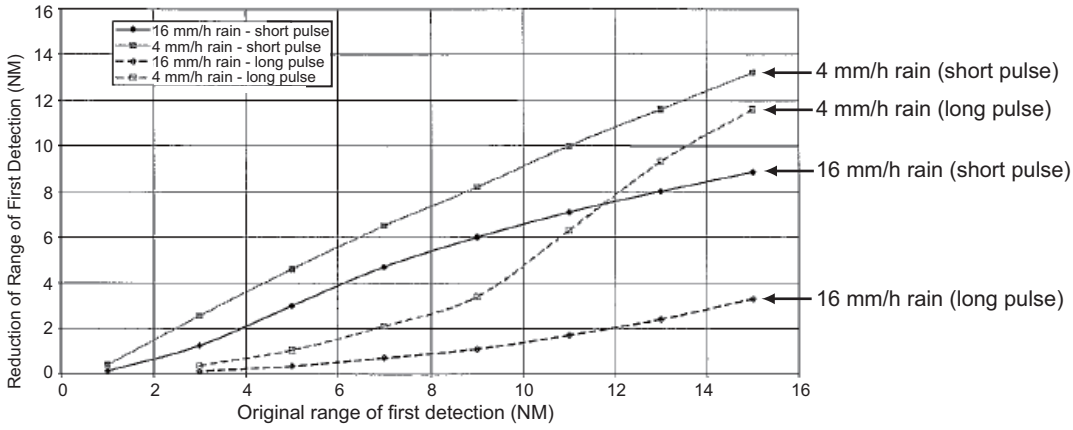
Control Unit: Push the **RAIN** control to display [MAN] on the [RAIN] mode indication on the Status bar. While watching the radar picture, adjust the **RAIN** control to reduce the clutter.

Trackball module: Click the [RAIN] mode indication on the Status bar to show [MAN]. For coarse adjustment, put the cursor within the slider bar area then push the left button. For fine adjustment, put the cursor at the end of the slider bar then roll the trackball while pushing and holding down the left button. Release the button to finish.

Note: The detection range is reduced when the RAIN is used to show targets in rain. Generally, the amount of rain, TX pulse length and TX frequency are factors in determining how the detection range is affected. The figures shown below illustrate this occurrence.



Reduction of rain to first detection due to rain at S-band



Reduction of rain to first detection due to rain at X-band

How to read the graph

Using the X-band graph as an example, a radar target detected in rain on the 8 nm range scale can only be detected at the ranges shown below:

4 mm/h rain (short pulse): approx 7.5 nm
16 mm/h rain (short pulse): approx 5.6 nm
4 mm/h rain (long pulse): approx 2.6 nm
16 mm/h rain (long pulse): approx 0.9 nm

2.9 How to Measure the Range to a Target

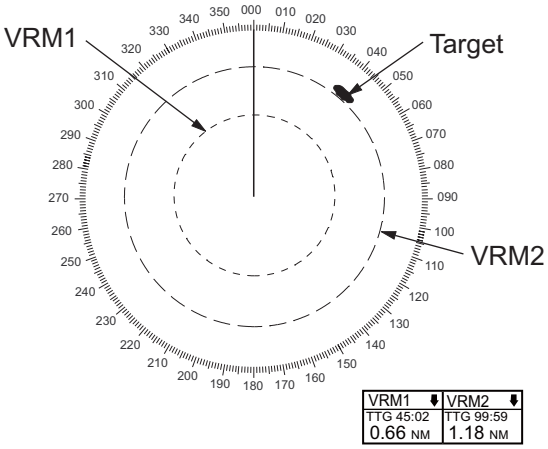
The range to a target may be measured three ways: with the fixed range rings, with the cursor, or with the VRM.

Use the range rings to obtain a rough estimate of the range to a target. They are the concentric solid circles about own ship, or the sweep origin. The number of rings is automatically determined by the selected range scale and their interval is displayed in the Range/Presentation mode box at the top-left position on the screen. Count the number of rings between the center of the display and the target. Check the range ring interval and judge the distance of the echo from the inner edge of the nearest ring.

The range rings can be turned on/off with [RANGE RING] on the [NAV TOOL] menu.

2.9.1 How to measure the range by using a VRM

There are two VRMs, No. 1 and No. 2, which appear as dashed rings so that you can distinguish them from the fixed range rings. The two VRMs can be distinguished from each other by the different lengths of their dashes; the dashes on the No. 2 VRM are longer.



How to measure the range from the Control Unit

1. Press the **VRM 1** or **VRM 2** key to display desired VRM.
2. Rotate the **VRM rotary** control to align the active variable range marker with the inner edge of the target of interest and read its distance at the bottom-right position on the screen. Each VRM remains at the same geographical distance when you operate the range control. This means that the apparent radius of the VRM ring changes in proportion to the selected range scale.

To erase a VRM, press the **VRM 1** or **VRM 2** key to erase corresponding VRM.

How to measure the range from the trackball module

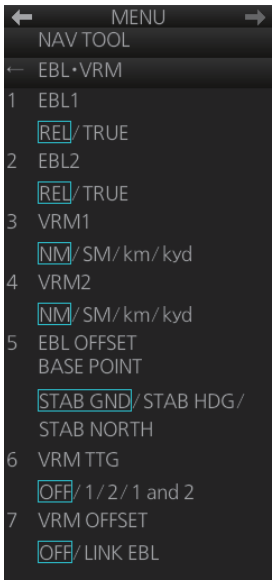
1. Click the title bar on a VRM box to activate the corresponding VRM.
2. Spin the scrollwheel or use the trackball to align the active variable range marker with the inner edge of the target of interest and read its distance at the bottom-right position on the screen. Each VRM remains at the same geographical distance when you operate the range control. This means that the apparent radius of the VRM ring changes in proportion to the selected range scale set the outer edge of the VRM on the inner edge of the target.
3. To anchor the VRM, push the left button.

To turn off a VRM, click the arrow in the applicable VRM box. The VRM disappears and the VRM box is minimized.

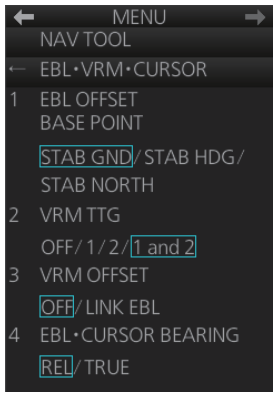
2.9.2 How to set VRM attributes

You can customize the VRMs to suit your needs.

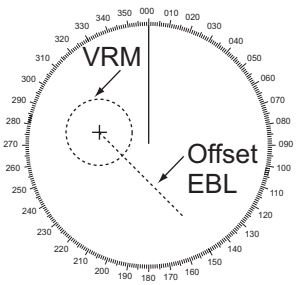
1. Open the menu then select [3 NAV TOOL] and [2 EBL VRM] (B type) or [2 EBL/VRM CURSOR] (IMO and A types) to display the [EBL/VRM] menu (EBL/VRM/CURSOR menu for the IMO and A types).
2. **For the B-type radar,** select [3 VRM1] or [4 VRM2] as appropriate. Spin the scrollwheel to select desired unit then push the left button.
3. Select [6 VRM TTG] (B type) or [2 VRM TTG] (IMO and A types) and then select the VRM(s) that are to show/hide the TTG indication. [OFF] shows no TTG indication.
4. The [LINK EBL] option for [7 VRM OFFSET] automatically activates the corresponding VRM when the offset EBL is enabled.
5. Close the menu.



B-type radar



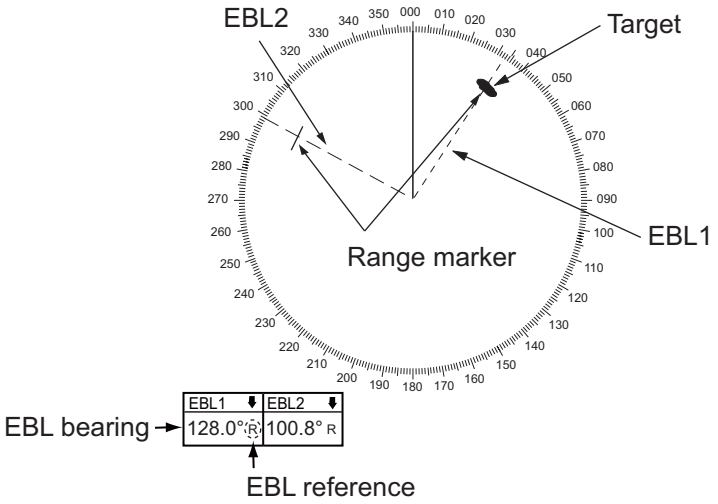
IMO- and A-type radars



2.10 How to Measure the Bearing to a Target

Use the Electronic Bearing Lines (EBLs) to take bearings of targets. There are two EBLs, No. 1 and No. 2. Each EBL is a straight dashed line extending from the own ship position up to the circumference of the radar picture. The two EBLs can be distinguished from each other by the different lengths of their dashes; the dashes on the No. 2 EBL are longer.

Each EBL carries a range marker, or a short line crossing the EBL at right angles. Its distance from the EBL origin is indicated at the VRM readout whether or not the corresponding VRM is displayed. The range marker changes its position along the EBL with the rotation of the VRM control. To operate this marker, rotate the **VRM rotary** control on the Control Unit, or put the cursor in the applicable VRM box and roll the scrollwheel.



2.10.1 How to measure the bearing

How to measure the bearing from the Control Unit

1. Press the **EBL 1** or **EBL 2** key to display desired EBL.
2. Rotate the **EBL rotary** control to bisect the target with the EBL. Read the bearing to the target at the appropriate EBL box.

To erase an EBL, press the EBL 1 or EBL 2 key to erase appropriate EBL.

How to measure the bearing from the trackball module

1. Click the title bar on a EBL box to activate the corresponding EBL.
2. Spin the scrollwheel or use the trackball to bisect the target with the EBL.
3. To anchor the EBL, push the left button.

To turn off an EBL, click the arrow in applicable EBL box. The EBL disappears and the EBL box is minimized.

2.10.2 How to select bearing reference

An EBL box has an "R" (relative) if the EBL bearing is relative to own ship's heading; "T" (true) if it is referenced to the north. True or relative indication is available regardless of presentation mode.

To change the bearing reference, click the EBL reference indication to display R or T as appropriate. The bearing reference can also be selected on the [EBL/VRM] menu ([EBL/VRM/CURSOR] menu with the IMO- and A-type radars).

Note: When the gyrocompass heading changes, the EBL and its indication change as follows:

Course-up, relative:	EBL indication remains the same, EBL moves.
Course-up, true:	EBL indication and EBL remain unchanged.
Head-up, relative:	EBL indication and EBL remain unchanged.
Head-up, true:	EBL indication remains the same; EBL moves.
North-up, relative:	EBL indication remains the same, EBL moves.
North-up, true:	EBL indication and EBL remain unchanged.

2.11 Collision Assessment by Offset EBL

The origin of the EBL can be placed anywhere with the trackball to enable measurement of range and bearing between two targets. This function is also useful for assessment of the potential risk of collision. It is possible to read CPA (Closest Point of Approach) by using a VRM as shown in Figure (a) on the next page. If the EBL passes through the sweep origin (own ship) as illustrated in Figure (b), the target ship is on a collision course.

2.11.1 How to assess risk of collision

How to assess risk of collision from the Control Unit

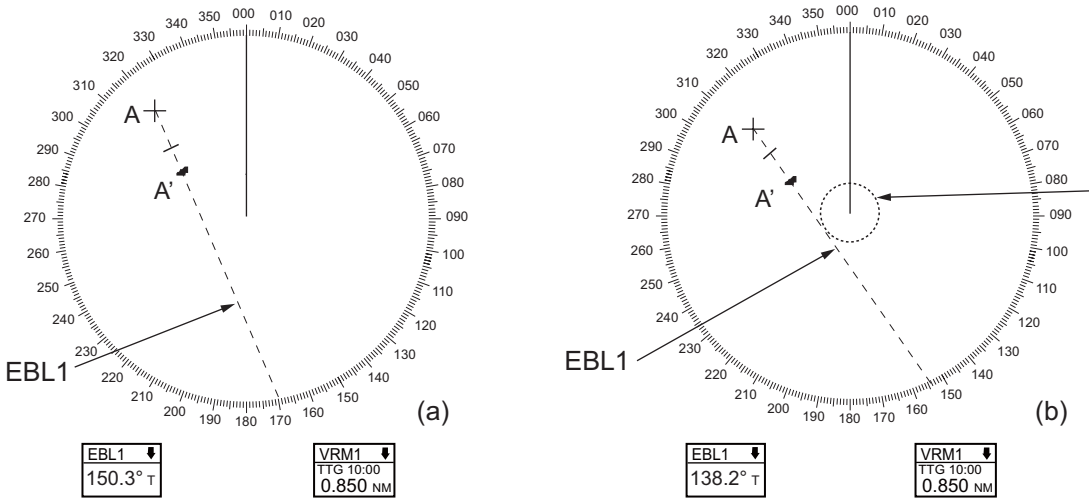
1. Press the **EBL1** or **EBL2** key to activate an EBL.
2. Put the cursor on a target that appears as a threatening target (A in the figure on the next page).
3. Press the **EBL OFFSET** key to shift the EBL origin to the cursor location.
4. Wait approx. three minutes. Operate the **EBL rotary** control to bisect the target at the new position (A'). The EBL indication shows the target ship's course, which may be true or relative depending on the EBL bearing reference setting.
5. If relative motion is selected, it is also possible to read CPA by using a VRM as shown in the left figure on the next page. If the EBL passes through the sweep origin (own ship) as illustrated in the right figure on the next page, the target ship is on a collision course.

To return the EBL origin to the center of the screen, press the **EBL OFFSET** key.

How to assess risk of collision from the context-sensitive menu

1. Right-click the display area to show the context-sensitive menu.
2. Select [EBL Offset] and then [EBL1] or [EBL2].
3. Put the cursor on a target that appears as a threat (A in the figure below).
4. Push the left button to shift the EBL origin to the cursor location.
5. Spin the scrollwheel or use the trackball to bisect the target at the new position (A'). The EBL indication shows the target ship's course, which may be true or relative depending on the EBL bearing reference setting.
6. It is also possible to read CPA by using a VRM as shown in left-hand figure below. If the EBL passes through the sweep origin (own ship) as illustrated in the right-hand figure below, the target ship is on a collision course.

To return the EBL origin to the center of the screen, put the cursor on the EBL origin then right-click.



2.11.2 Point of reference for origin point of offset EBL

The origin point of the offset EBL can be ground stabilized (geographically fixed), north stabilized (true) or referenced to your ship's heading (relative).

1. Open the menu then select the [3 NAV TOOL] and [2 EBL VRM] (B type) or [2 EBL/VRM/CURSOR] (IMO and A types) menus to display the [2 EBL VRM] (B type) or [2 EBL/VRM/CURSOR] (IMO and A types) menu.
2. Select [5 EBL OFFSET BASE POINT] (B type) or [1 EBL OFFSET BASE POINT] (IMO and A types).
3. Select [STAB GND], [STAB HDG], or [STAB NORTH] as appropriate.
   STAB GND: Reference to latitude and longitude. Origin position is always fixed regardless of your ship's movement.
   STAB HDG: Reference to heading. The relationship between origin position and own position is kept always.
   STAB NORTH: Reference to North. The origin position changes with North position.
4. Close the menu.

2.12 How to Measure the Range and Bearing Between Two Targets

How to measure the range and bearing between two targets from the Control Unit

1. Press the **EBL1** to activate EBL1.
2. Operate the trackball to place the origin of the EBL1 on a target of interest.
3. Press the **EBL OFFSET** key.
4. Operate the **EBL rotary** control to bisect the other target of interest.
5. Operate the **VRM rotary** control until the range marker on the EBL is on the inside edge of target 2.

You can repeat the same procedure on third and fourth targets (targets 3 and 4) by using the EBL2 and the VRM2.

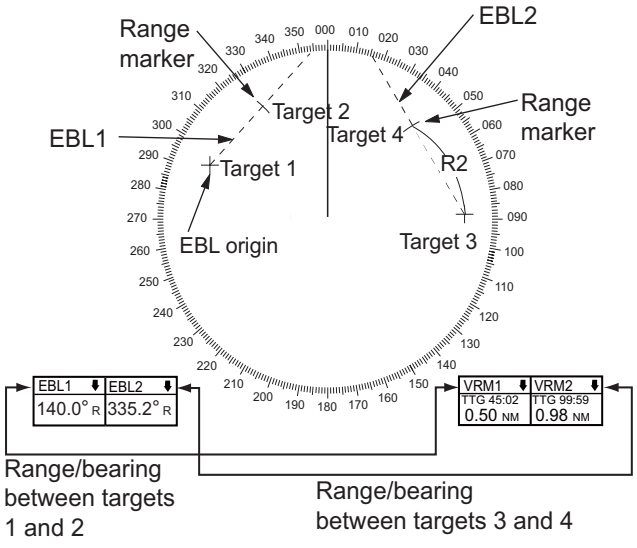
Bearing is shown relative to own ship with suffix "R" or as a true bearing with suffix "T". To return the EBL origin to the screen center, push the **EBL OFFSET** key.

How to measure the range and bearing between two targets from the track-ball module

1. Right-click the display area to show the context-sensitive menu.
2. Select [EBL Offset] then [EBL1].
3. Put the origin of the EBL on a target of interest.
4. Push the left button to anchor the EBL.
5. Spin the scrollwheel or use the trackball to bisect the other target of interest.
6. Put the cursor on the VRM1 box then spin the scrollwheel to put the range marker on the EBL on the inside edge of target 2.

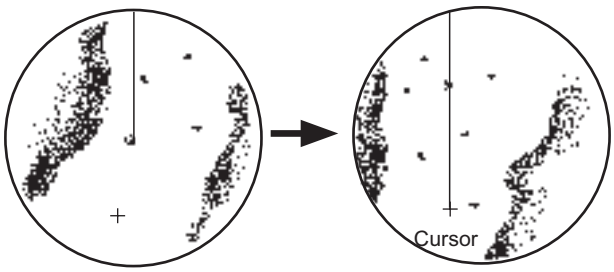
You can repeat the same procedure on third and fourth targets (targets 3 and 4) by using the EBL2 and the VRM2.

Bearing is shown relative to own ship with suffix "R" or as a true bearing with suffix "T". To return the EBL to its origin, open the context-sensitive menu then select [Reset EBL].



2.13 How to Off-center the Display

Own ship position, or sweep origin, can be displaced to expand the view field without switching to a larger range scale. The sweep origin can be off-centered to the cursor position, but not more than 75% of the range in use; if the cursor is set beyond 75% of the range scale, the sweep origin will be off-centered to the point of 75% of the limit.



Normal display *Off-centered display*

This feature is available on the ranges between 0.125 and 48 NM and any presentation mode other than true motion.

If the position of the CCRP results in a part of the bearing scale not being distinguishable, that part of the bearing scale is indicated with appropriate reduced detail.

How to off-center the display from the Control Unit

1. Put the cursor on the position within the display area where you want to move the sweep origin.
2. Press the **OFF CENTER** key to move the sweep origin to the cursor position.

To cancel off-centering, press the **OFF CENTER** key again.

How to off-center the display from the context-sensitive menu

1. Put the cursor where you want to off-center the display then right-click to show the context-sensitive menu.
2. Select [Off Center].
3. Push the left button. Then, the sweep origin is off-centered to the cursor position.

To cancel the off-center display, put the cursor on the sweep origin and right-click.

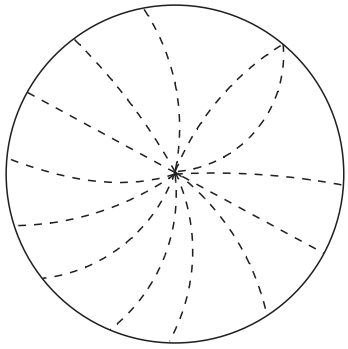
If you cannot cancel off-center…

When the conditions shown below are met, offcenter cannot be cancelled. This is because the radar antenna position is located at a position greater than 75% of the effective radar display.

- Own ship marker is large.
- The distance between the antenna position and the conning position is large.
- Short-distance display range.

To cancel the off-center in the above-mentioned conditions, first select a larger range, then cancel the off-center.

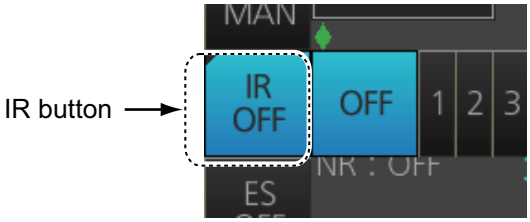
2.14 Interference Rejector



Mutual radar interference may occur in the vicinity of another shipborne radar operating in the same frequency band. It is seen on the screen as a number of bright spikes either in irregular patterns or in the form of usually curved spoke-like dotted lines extending from the center to the edge of the picture. Activating the interference rejector circuit can reduce this type of interference.

The interference rejector is a kind of signal correlation circuit. It compares the received signals over successive transmissions and reduces randomly occurring signals. There are three levels of interference rejection depending on the number of transmissions that are correlated.

Click the [IR] button on the InstantAccess bar then click desired rejection level. The higher the number the greater the degree of interference rejection.

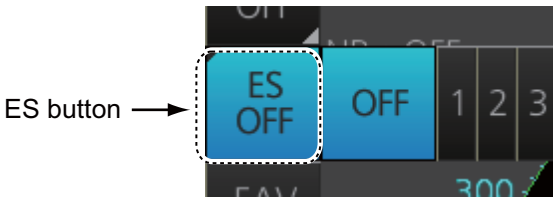


2.15 Echo Stretch

The echo stretch feature enlarges targets in the range and bearing directions to make them easier to see, and it is available on any range. There are three levels of echo stretch, 1, 2 and 3. The higher the number the greater the amount of stretching.

The echo stretch magnifies not only small target pips but also returns from the sea surface, rain and radar interference. For this reason, suppress those types of interference before activating the echo stretch.

Click the [ES] button on the InstantAccess bar then click desired echo stretch level.



2.16 Echo Averaging

The echo averaging feature, which requires heading, position and speed data, effectively reduces sea clutter. Echoes received from stable targets such as ships appear on the screen at almost the same position every rotation of the antenna. On the other hand, unstable echoes such as sea clutter appear at random positions.

To distinguish real target echoes from sea clutter, echoes are averaged over successive picture frames. If an echo is solid and stable over successive frames, it is presented in its normal intensity. Sea clutter is averaged over successive scans and its brilliance reduced, making it easier to discriminate real targets from sea clutter.

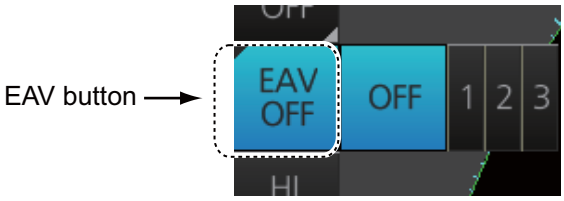
Echo averaging uses scan-to-scan signal correlation technique based on the true motion over the ground of each target. Thus, small stationary targets such as buoys will be shown while reducing random echoes such as sea clutter. True echo averaging is not however effective for picking up small targets running at high speeds over the ground.

Note 1: With echo average active it is harder to detect high-speed targets than stationary ones.

Note 2: Do not use echo averaging under heavy pitching and rolling; loss of targets can result.

Before using the echo averaging function, reduce sea clutter with the **A/C SEA** control. Leave a little sea clutter on the screen so as not to erase weak targets. Then, do as follows:

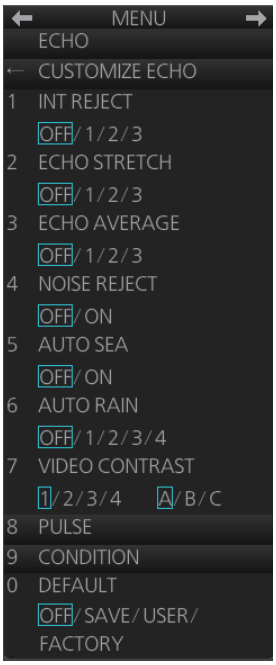
Click the [EAV] button on the InstantAccess bar then click desired setting.
OFF: Echo averaging OFF.
1, 2: Detects targets hidden in sea clutter. "2" is more effective than "1" in detecting targets hidden in strong sea clutter. However, "1" is more effective than "2" in displaying high-speed targets. Select the setting best suited to your objective.
3: Stably displays unstable targets; distinguishes high-speed craft from sea clutter.



2.17 Noise Rejector

White noise may show itself on the screen as random "speckles" spread over the entire radar image. You can remove this noise as follows:

1. Open the menu then select the [1 ECHO] and [1 CUSTOMIZE ECHO] menus to show the [CUSTOMIZE ECHO] menu.



2. Select [4 NOISE REJECT].
3. Select [OFF] or [ON] as appropriate.
4. Close the menu.

The status of the noise rejector is indicated at the top-left position, [NR: ON] or [NR: OFF].

Noise Rejector ON

Noise Rejector OFF

2.18 Wiper

The wiper feature automatically reduces the brilliance of unwanted weak echoes, such as noise, sea clutter and rain clutter, to clear the picture. There are two wiper settings, 1 and 2. The difference between 1 and 2 is that the brilliance is lowered more slowly in 2.

To use the wiper feature, do the following:

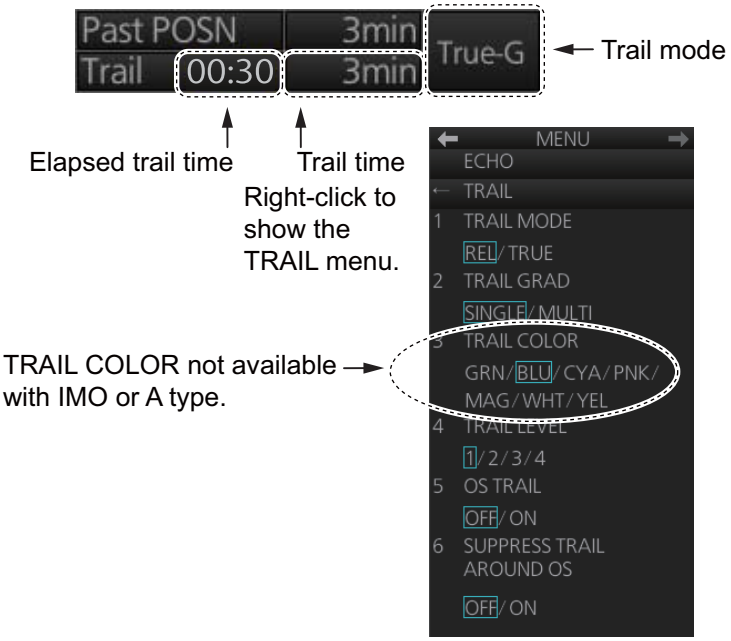
1. Open the main menu.
2. Select [1 ECHO] to show the [1 ECHO] menu.
3. Select [8 WIPER] (B type) or [7 WIPER] (IMO and A types).
4. Select [OFF], [1] or [2] as appropriate.
5. Close the menu.

2.19 Target Trails

The trails of the radar echoes of targets may be displayed in the form of synthetic afterglow. Target trails are selected either relative or true and may be sea or ground stabilized. True motion trails require a compass signal, and position and speed inputs.

2.19.1 Target trails-related indications

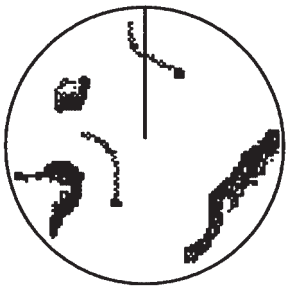
Trail-related indications are located at the bottom-right position on the screen. Several trail-related operations can be done from the [TRAIL] menu, which you can show by right-clicking the Trail time indication.



2.19.2 True or relative target trails

You may display echo trails in true or relative motion. Relative trails show relative movements between targets and own ship. True motion trails present true target movements in accordance with their over-the-ground speeds and courses. The trail and past position modes in the North-up true motion are fixed to True.

Click the Trail mode indication to select [True-G] or [REL] as appropriate.



True target trails
(No smearing of stationary targets)

Relative target trails
(Targets moving relative to own ship)

2.19.3 Trail time

Trail time, the trail plotting interval, can be selected with the scrollwheel, left button or right button.

The trail timer counts up the trail time and is erased once the terminal count is reached. For example, if the trail time is six minutes, the timer is erased when trails have been plotted six minutes. The maximum time for continuous plotting is 99:59.

How to select a trail time

Four controls are available to select a trail time. The times available depend on the control used as shown in the table below.

- **Left button**, **right button** or **scrollwheel**: Put the cursor on the Trail time indication at the bottom-right position then operate the control. For the right button, a context-sensitive menu appears. Click the desired time.
- **Control Unit**: Push the **TRAIL** key.

Control	Available setting
Left button, right button, **TRAIL** key	OFF, 15 sec, 30 sec, 1 min, 3 min, 6 min, 15 min, 30 min, CONT(inuous)
Scrollwheel	OFF, 15 sec, 30 sec, 1-30 min (30 sec intervals), CONT(inuous)

2.19.4 How to reset target trails

All trails may be erased (including those in the memory) and restarted to start trails fresh.

Control Unit: Press and hold down the **TRAIL** key until trails disappear.
Context-sensitive menu: Right-click the display area to show the context-sensitive menu then select [Delete All Trails].

2.19.5 How to temporarily remove all target trails from the display

You may wish to temporarily remove all trails from the display. Trails are removed but are continued internally.

Control Unit: Press the **TRAIL** key to show [OFF] in the trail time indication.
Trackball module: Click the trail time indication to display [OFF].

2.19.6 Trail stabilization in true motion

True motion trails may be ground stabilized or sea stabilized. The [Trail time] indication shows current stabilization as [True-G] or [True-S]. To change the stabilization mode, open the [SPEED] menu and set [SHIP SPEED] to [BT] (ground stabilization) or [WT] (sea stabilization). When the stabilization mode is changed, true trails are reset. (Relative trails are not reset.)

2.19.7 Target trail attributes on the TRAIL menu

TRAIL GRAD: The afterglow of the target trails can be shown in a single tone or gradual shading.

Monotone (Single) Gradual shading (Multi)

TRAIL COLOR: The trail color can be selected from the colors shown in the left figure. This feature is not available with the IMO or A type.
TRAIL LEVEL: The level (intensity) of the afterglow that extends from radar targets can be adjusted. The higher the number the greater the intensity of the afterglow.
OS TRAIL: Show or hide trail for own ship.
SUPPRESS TRAIL AROUND OS: You can prevent the display of sea clutter in true trails about your ship, to clear the radar picture.

Note: [SUPPRESS TRAIL AROUND OS] is automatically turned on when [OS TRAIL] is activated. The possible ON/OFF combinations between [OS TRAIL] and [SUPPRESS TRAIL AROUND OS] are as shown in the table below.

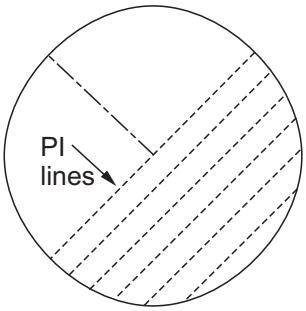
Setting	ON/OFF pairings available			
OS TRAIL*1	OFF	ON	OFF	ON
SUPPRESS TRAIL AROUND OS	OFF	ON	ON	OFF
Remarks	No OS trail	-	-	Setting not possible

*1 When activated, [SUPPRESS TRAIL AROUND OS] automatically turns on.

2.20 Parallel Index (PI) Lines

PI lines are useful for keeping a constant distance between own ship and a coastline or a partner ship when navigating. Up to six sets of PI lines are available depending on the maximum number of PI lines selected on the menu.

Control of the orientation and interval of the PI lines is done from the PI line box, which is at the bottom-left position.



2.20.1 How to display, erase a PI line

How to display, erase a PI line from the Control Unit

Displaying a PI line: Press the **INDEX LINE** key until desired PI line no. appears.
Erasing a PI line: Press the **INDEX LINE** key until desired PI line no. appears. Press and hold down the **INDEX LINE** key to erase the PI line.

How to display, erase a PI line from the trackball module

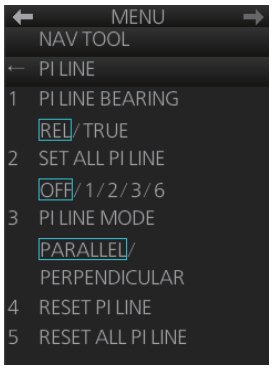
Click the PI line no. indication to select a PI line. Click the PI line status indication (ON, OFF) to display or erase a PI line.

2.20.2 How to adjust PI line orientation, PI line interval

1. If not already displayed, display a PI line.
2. Put the cursor on the PI line angle indication then spin the scrollwheel to set the angle (000-359.9). Enter a negative value to move the PI line to the opposite side of the PI line that passes through your position.
3. Put the cursor on the PI line interval indication then spin the scrollwheel to adjust the PI line interval.

2.20.3 PI line attributes on the PI LINE menu

Various PI line attributes (bearing reference, mode, etc.) can be set from the [1 PI LINE] menu. Open the menu then select the [3 NAV TOOL] and [1 PI LINE] menus to show the [PI LINE] menu.



PI LINE BEARING: PI line bearing reference may be relative to your ship's heading (Relative) or referenced to North (True).
SET ALL PI LINE: The maximum number of PI lines to display may be selected among 1, 2, 3 or 6 lines. The actual number of lines visible may be less depending on line interval.
PI LINE MODE: PI lines orientation may be selected from parallel or perpendicular. This function is available when [2 SET ALL PI LINE] is set for other than "1".

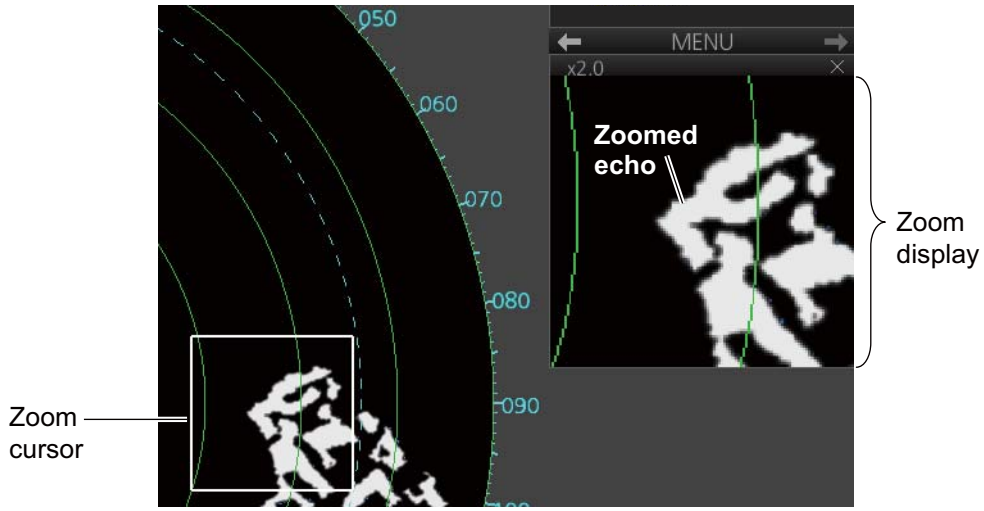
2.20.4 How to reset PI lines

You can automatically return all or selected PI lines to default orientation, 0-degrees for parallel orientation, 90-degrees for perpendicular orientation. This is faster than doing it manually.

1. Open the menu.
2. Select [3 NAV TOOL] and [1 PI LINE] to show the [1 PI LINE] menu.
3. Select [4 RESET PI LINE] (reset currently displayed line) or [5 RESET ALL PI LINE] as appropriate. You are asked if you are sure to reset the PI line(s). Click the [OK] button to reset the PI line(s).
4. Close the menu.

2.21 Zoom

The zoom function enlarges an area of interest twice the normal viewing size, in the information area. To use the zoom display, right click the operational area to show the context-sensitive menu then select [Zoom Set]. Roll the trackball to put the zoom cursor on the area to zoom. See the zoom display at the right side of the screen.



2.22 Markers

2.22.1 Heading line

The heading line indicates the ship's heading in all presentation modes. The heading line is a line from the own ship position to the outer edge of the radar display area and appears at zero degrees on the bearing scale in head-up mode. It changes its orientation in the north-up and true motion modes according to orientation.

Temporarily erasing the heading line

To temporarily extinguish the heading line (and anything but radar echoes within the display area) to look at targets existing dead ahead of own ship, push the **HL OFF** key on the Control Unit, or click the [HL OFF] button on the InstantAccess bar. Release the respective control to redisplay the heading line, etc.

2.22.2 Stern marker

The stern marker, which is a dot-and-dash line, appears opposite to the heading line and marks your ship’s stern. To display or erase this marker, do the following:

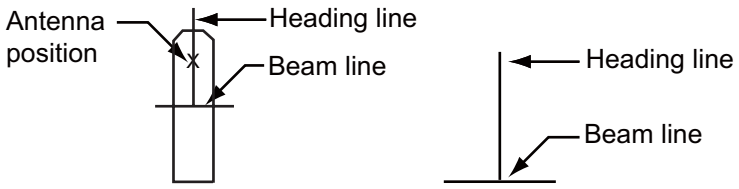
1. Open the main menu.
2. Select [5 MAP MARK] and [1 MARK SETTING].
3. Select [6 STERN MARK] (B type) or [5 STERN MARK] (IMO and A types).
4. Select [ON] or [OFF] as appropriate.

2.22.3 North marker

The north marker appears as a short dashed line. In the head-up mode, the north marker moves around the bearing scale in accordance with the compass signal.

2.22.4 Own ship marker

The own ship marker is displayed at your ship's position. It can be turned on or off and its configuration selected from the [MARK SETTING] menu. Two configurations are available: minimized marker and scaled marker. The scaled marker is scaled according to the length and beam of the vessel. If the beam width or length of the marker (set at installation) gets smaller than 6 mm, the marker is replaced with the minimized marker. Ship's dimensions should be entered at installation to use the scaled marker.

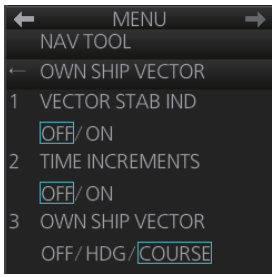


Scaled marker *Minimized marker*

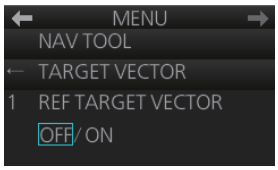
1. Open the main menu.
2. Select [5 MAP MARK] and [1 MARK SETTING].
3. Select [4 OWN SHIP MARK] (B type) or [3 OWN SHIP MARK] (IMO and A types).
4. Select [MIN] or [SCALED] as appropriate.
   MIN: Show the minimized own ship marker.
   SCALED: Show the scaled own ship marker.

2.22.5 Vectors

You can show or hide the vector for own ship and reference targets, on the [NAV TOOL] menu.



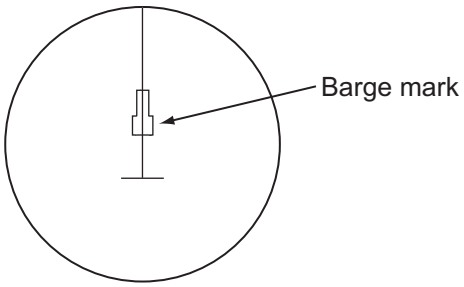
OWN SHIP VECTOR menu
VECTOR STAB IND: Turn ON to show double arrow for ground tracking; single arrow for water tracking.
TIME INCREMENTS: A short horizontal line may be marked on the own ship vector in one-minute intervals to show approximate later positions.
OWN SHIP VECTOR: Turn vector OFF, or show ship's heading or course with a vector.



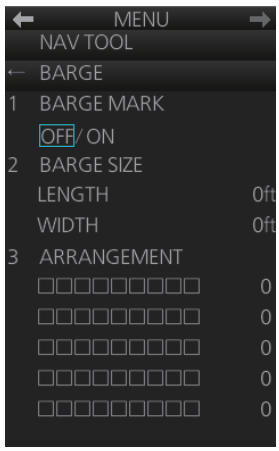
TARGET VECTOR menu
REF SHIP VECTOR: Turn the vector for the reference target on or off.

2.22.6 Barge marker

The length and breadth of the total barge size can be displayed as a simple rectangle on the radar display. Up to five rows of barges and nine barges per row can be shown.



This feature is available with an installation preset. Set up barge information as follows:



1. Open the main menu.
2. Select the [3 NAV TOOL] and [7 BARGE] (B type) or [6 BARGE] (IMO and A types) to show the [BARGE] menu.
3. Select [1 BARGE MARK].
4. Select [ON] to turn on the barge mark.
5. At [2 BARGE SIZE], enter length (three digits) and width (two digits) of the total number of barges.
6. Select [3 ARRANGEMENT].
7. Enter the number of barges that will be in front of your vessel, row by row:
   1) Select a barge row.
   2) Spin the scrollwheel to set the number of barges in the row. (The maximum number is nine.) The numerical indication to the right of the squares changes with scrollwheel operation.
   3) Push the left button to confirm your selection. The squares on the row are “filled” according to the number of barges selected at step 2).
8. Close the menu.

The radar display now shows the barge mark on the display.

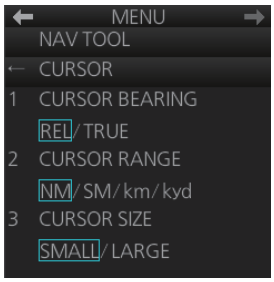
2.22.7 Antenna marker

The antenna marker appears as a small blue circle at the antenna location. The marker can be shown or hidden as follows:

1. Open the main menu.
2. Select [5 MAP MARK] and [1 MARK SETTING].
3. Select [5 ANTENNA MARK] (B type) or ([4 ANTENNA MARK] (IMO and A types).
4. Select [ON] or [OFF] as appropriate.

2.22.8 Cursor

The cursor measures the range and bearing to an object, selects menu items, selects location for mark entry, etc. For the B-type radar, you can select cursor attributes (bearing reference, range unit and size for the cursor) on the [CURSOR] menu in the [NAV TOOL] menu. For the IMO- and A-type radars you can select only the cursor bearing reference, with [EBL/CURSOR BEARING] in the [EBL/VRM/CURSOR] menu of the [NAV TOOL] menu.



CURSOR BEARING: Show cursor bearing reference in true or relative.

CURSOR RANGE: Show the cursor range indication in the NM, SM, km or kyd. Not available with either IMO- or A-type radar.

CURSOR SIZE: Select the cursor size for small or large. The large cursor covers the entire echo area. Not available with either IMO- or A-type radar.

2.23 How to Preset Controls for Specific Navigation Purpose

Every time your navigating environment or task changes, you must adjust the radar, which can be a nuisance in a busy situation. Instead of changing radar settings case by case, it is possible to assign the function keys to provide optimum settings for often-encountered situations.

The radar's internal computer offers several picture preset options to be assigned to each function key for your specific navigating requirements. For instance, one of the presets is labelled HARD RAIN, and is designed to be used in heavy rain.

Two user-programmable presets are also provided (labeled CUSTOM1, CUSTOM2), so that you can have the radar automatically adjusted to those conditions that are not covered by the provided setup options.

Below are the preset options provided with this radar.

Label	Description	Label	Description
OCEAN	Optimum setting for long range detection, on a range scale of 6 nm or larger.	ROUGH SEA	Optimum setting for operation in rough seas.
CANAL	Optimum setting for operating in a canal.	HARD RAIN	Optimum setting for rough weather or heavy rain.
BERTHING	Optimum setting when berthing.	CUSTOM1	User-defined custom settings.
CONGESTION	Optimum setting for short range navigation (for example, a harbor) using a range scale of 1.5 nm or less.	CUSTOM2	User-defined custom settings.

Each picture option defines a combination of several radar settings for achieving optimum setup for a particular navigating situation. These include interference rejector, echo stretch, echo average, noise rejector, automatic anti-sea and anti-rain clutters, video contrast, pulse length and sea and radar conditions.

Adjusting these features from the [CUSTOMIZE ECHO] menu changes the original function key settings. To restore the original settings for a particular customize option, it is necessary to select the default setting. For this reason, we recommended that you use the user-programmable presets when frequent adjustment of the radar image is necessary.

	INT REJECT	ECHO STRETCH	ECHO AVERAGE	NOISE REJ	AUTO SEA	AUTO RAIN	VIDEO CONTRAST
OCEAN	2	2	3	ON	OFF*	OFF*	3-B
CANAL	2	OFF	OFF	OFF	OFF*	OFF*	2-B
BERTHING	2	OFF	OFF	OFF	OFF*	OFF*	2-B
CONGESTION	2	OFF	2	OFF	OFF*	OFF*	1-B
ROUGH SEA	2	OFF	2	OFF	OFF*	OFF*	2-A
HARD RAIN	2	OFF	OFF	OFF	OFF*	AUTO2	2-A
CUSTOM1	2	OFF	OFF	OFF	OFF*	OFF*	1-B
CUSTOM2	2	2	1	OFF	OFF*	OFF*	2-B

* Manual

8 PULSE

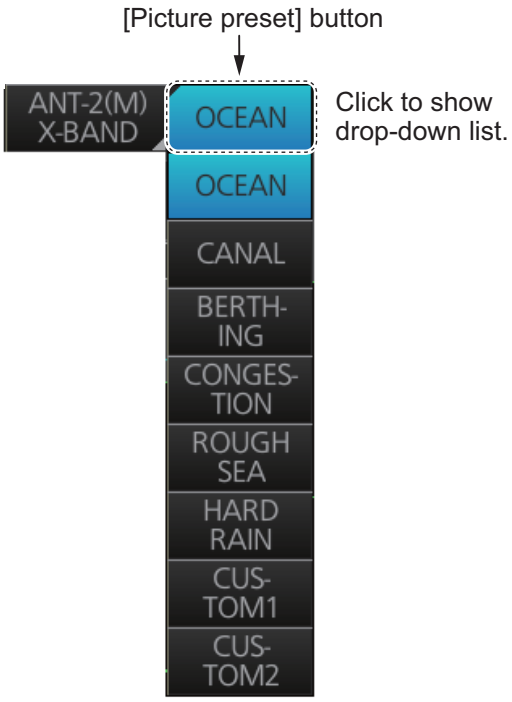
	P/L on 0.5 nm	P/L on 0.75 nm	P/L on 1.5 nm	P/L on 3 nm	P/L on 6 nm	P/L on 12, 24 nm
OCEAN	S2	M1	M1	M3	L	L
CANAL	S1	S2	M1	M2	M3	L
BERTHING	S1	S1	S2	M1	M3	L
CONGESTION	S1	S2	S2	M1	M2	L
ROUGH SEA	S1	S1	S2	M1	M2	M3
HARD RAIN	S1	S2	S2	M1	M2	L
CUSTOM1	S1	S2	S2	M1	M1	L
CUSTOM2	S2	S2	M1	M2	M3	L

9 CONDITION

	SEA COND.	ANT. HEIGHT	LOW LEVEL ECHO	STC RANGE	GAIN	SEA	RAIN
OCEAN	3	Set at in-stallation	0	±0	80	MAN-30	MAN-0
CANAL	2		0	±0	80	MAN-30	MAN-0
BERTHING	2		0	±0	80	MAN-30	MAN-0
CONGESTION	3		0	±0	80	MAN-30	MAN-0
ROUGH SEA	4		0	±0	80	MAN-60	MAN-0
HARD RAIN	2		0	±0	80	MAN-60	MAN-0
CUSTOM1	2		0	±0	80	MAN-30	MAN-0
CUSTOM2	2		0	±0	80	MAN-30	MAN-0

2.23.1 How to select a picture preset

Click the [Picture preset] button on the Status bar to select a picture preset option from the drop-down list.

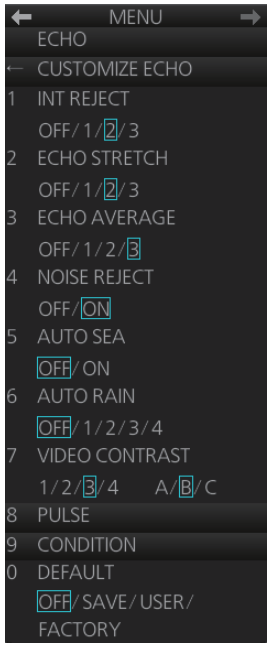


2.23.2 User-programmable picture presets

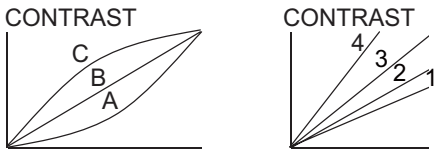
Two user-programmable picture setups are provided and they are labeled CUSTOM1 and CUSTOM2 on the [Picture preset] button. You can program them as below.

1. Right-click the [Picture preset] button on the Status bar then click [Customize Echo Menu].
2. Set the items below referring to the sections shown.

   Int Reject: section 2.14
   Echo Stretch: section 2.15
   Echo Average: section 2.16
   Noise Reject: section 2.17
   Auto Sea: section 2.7
   Auto Rain: section 2.8
   Pulse Length: section 2.5
3. Click [7 VIDEO CONTRAST].



4. Spin the scrollwheel to select 1, 2, 3 or 4 (Dynamic Range) or A, B, C (Curve) as appropriate then push the left button. Refer to the description and illustration below.
   1-4: Control dynamic range. 1 provides the widest dynamic range; 4 is the narrowest dynamic range.
   A: The mid-level in the curve is low, so this setting is suitable for suppressing rain clutter.
   B: Curve between A and C.
   C: The mid-level in the curve is high, so this setting is suitable for detecting distant targets.



5. Click [9 CONDITION].
6. Spin the scrollwheel to select appropriate sea condition then push the left button. The larger the number the rougher the sea state.
7. Click [2 STC ANT HEIGHT].
8. Spin the scrollwheel to select appropriate radar antenna height (above the waterline) then push the left button.
9. If necessary, select [3 LOW LEVEL ECHO] to reject low level echoes. The setting range is 0-8. The higher the figure, the stronger the low level echo that is erased.
10. To save the custom settings, select [SAVE] from [0 DEFAULT].
11. Click the Close button (X) to close the menu.

2.23.3 How to restore user picture preset

If you get lost in operation while adjusting the settings for a user picture preset, you can easily restore the default settings for that user picture preset. Note that user settings are deleted when default settings are restored.

1. Click the [Picture preset] button on the Status bar then click the picture preset option for which you want to restore its user settings.
2. Right-click then select [Customize Echo Menu].
3. Click the [User] button.
4. Click the Close button (X) to close the menu.

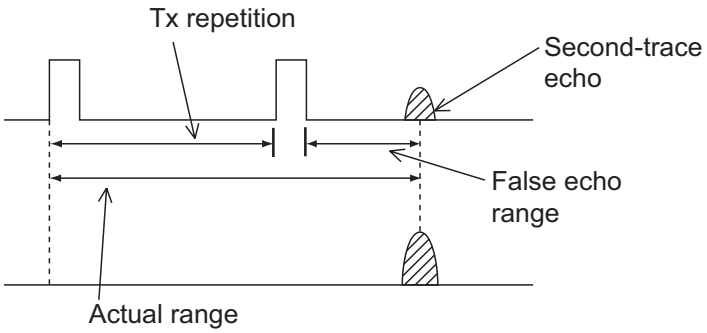
2.23.4 How to restore default picture preset options

Any of the radar functions programmed with the picture setup options may be adjusted as desired. If you get lost in operation and want to restore the default settings for a particular picture setup operation, do the following:

1. Click the [Picture preset] button on the Status bar to select the picture preset option for which you want to restore its user settings.
2. Right-click then select [Customize Echo Menu].
3. Click [0 DEFAULT].
4. Select [FACTORY].
5. Click the Close button (X) to close the menu.

2.24 How to Suppress Second-trace Echoes

In certain situations, echoes from very distance targets may appear as false echoes (second-trace echoes) on the screen. This occurs when the return echo is received one transmission cycle later, or after a next radar pulse has been transmitted.

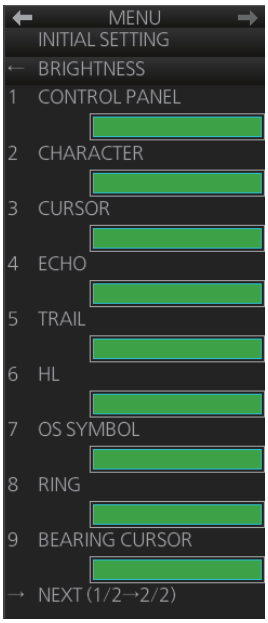


To reject second-trace echoes, open the [1 ECHO] menu then set [5 2ND ECHO REJ] (B type) or [4 2ND ECHO REJ] (IMO and A types) to [ON] then close the menu.

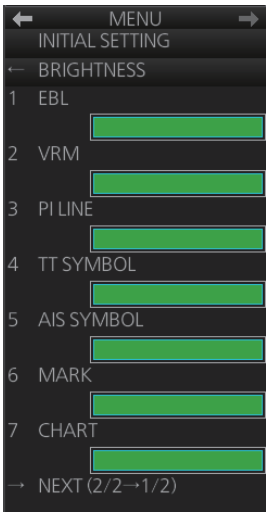
2.25 How to Adjust Brilliance of Screen Data

You can adjust the relative brilliance levels of various markers and alphanumeric read-outs displayed on the screen.

1. Right-click the [BRILL] button on the InstantAccess bar then select the [BRILL] menu.



[BRILL] menu, page 1



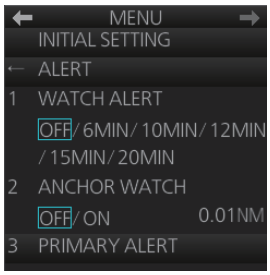
[BRILL] menu, page 2

2. Click the brilliance adjustment bar of the item to adjust.

Page 1		Page 2	
Item	**Adjusts brightness of;**	**Item**	**Adjusts brightness of;**
1 CONTROL PANEL	backlighting of keys on Control Unit	1EBL	EBLs, blind sector
2 CHARACTER	Alphanumeric characters	2 VRM	VRMs
3 CURSOR	Cursor	3 PI LINE	PI lines
4 ECHO	Radar echoes	4 TT SYMBOL	TT symbols, AZ area, TT vector, TT past posn
5 TRAIL	Target trails	5 AIS SYMBOL	AIS symbols, AIS vector, AIS past posn
6 HL	Heading line, stern line	6 MARK	Radar map marks
7 OS SYMBOL	Own ship symbol, barge mark, antenna mark, own ship track, own ship vector	7 CHART	Chart-related objects
8 RING	Fixed range rings		
9 BEARING CURSOR	Bearing cursor		

3. Spin the scrollwheel to set brilliance level.
4. Close the menu.

2.26 Watch Alert



The watch alert provides a flashing visual alert at regular intervals to remind you to monitor the radar picture for safety or other purposes.

To enable the watch alert, open the [8 INITIAL SETTING] menu followed by the [4 ALERT] menu. Select [WATCH ALERT] and set desired watch interval. The [Watch] box appears at the bottom-left position. (The watch interval can also be selected from the [Watch] box when the watch alert feature is active. Right-click the time indication in the [Watch] box to show a drop-down list of watch intervals. Select a watch interval from the list.)

Watch box

The timer counts down from the interval set (for example, "12:00") and when the time interval elapses;

- the buzzer sounds
- the visual alert 500 “Watch Alert” flashes in yellow in the [Alert] box
- the watch alert timer freezes at "0:00."

Stop the flashing visual alert with the **ALARM ACK** key on the Control Unit or click the [Alert] box. If the alert is not acknowledged within one minute, the alert category changes to “warning” (the Alert 500 flashes in red in the [Alert] box and the buzzer sounds).

After the alert is acknowledged the count-down sequence is repeated.

If you silence the buzzer before the selected time interval is reached, the watch alert timer is reset to the initial value and the count-down sequence is restarted.

2.27 Information Box

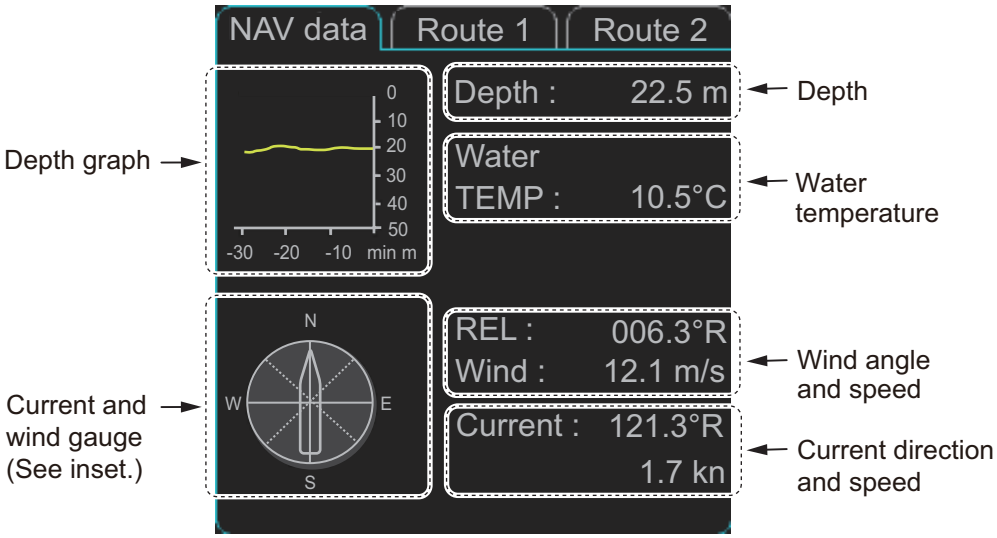
The information box shows navigation data and, when following a route set on the chart display, route information is also shown.

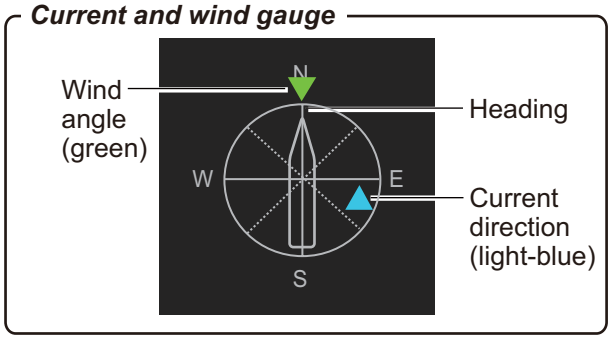
2.27.1 Information box contents

Navigation data

- Depth, analog and graph
- Current (tide) speed and direction
- Waypoint data (waypoint no., range to waypoint, bearing to waypoint
- Wind speed and direction
- Water temperature
- Current and wind gauge

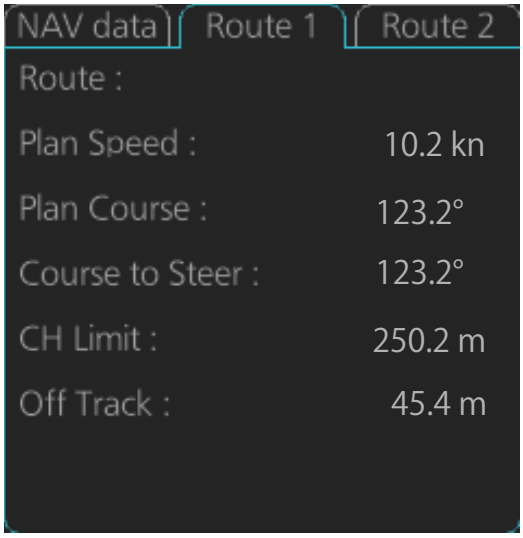
Nav data requires appropriate navigation sensors and NMEA0183 sentences output from the sensor. If there is no sentence or data input, asterisks (**) appear at the corresponding indication.





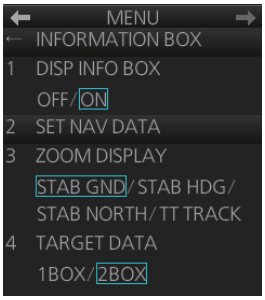
Route information

The route information displays plan speed, plan course, course to steer, channel limit, and off track of a maximum of two routes. Click a [Route] tab to find route information.



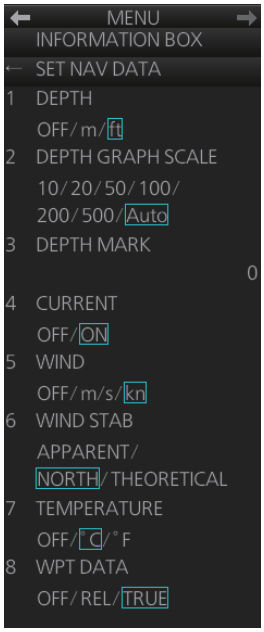
2.27.2 How to show the information box

1. Open the menu and select [4 INFORMATION BOX].



2. Select [1 DISP INFO BOX] then [ON].
3. Close the menu.

2.27.3 How to turn NAV data on/off



Wind, depth, ocean current, water temperature, date and time and waypoint data may be set up as follows:

1. Open the menu then select [4 INFORMATION BOX].
2. Select [2 SET NAV DATA].
3. Set up the nav data referring to the table below.
4. Close the menu.

Nav data menu description

Item	Description
1 DEPTH	Selects unit of depth measurement, or turn depth indication OFF.
2 DEPTH GRAPH SCALE	Selects depth scale range. The depth for the last 30 minutes is plotted with a yellow line. The [AUTO] setting automatically adjusts the scale according to depth.
3 DEPTH MARK	Selects the depth at which to show the depth mark.
4 CURRENT	Turns the current (tide) display ON (current relative to North) or OFF.
5 WIND	Selects the unit of wind speed measurement.
6 WIND STAB	Selects Wind vector format, among three choices: **APPARENT**: Apparent wind measured by wind meter, with ship's bow as reference. **NORTH**: Apparent wind minus ship's movement, with North as reference **THEORETICAL**: Apparent wind minus ship's movement, with ship's bow as reference.
7 TEMPERATURE	Turns water temperature indication ON or OFF and selects the unit of measurement.
8 WPT DATA	Turns waypoint data OFF, or selects waypoint data reference, true or relative.

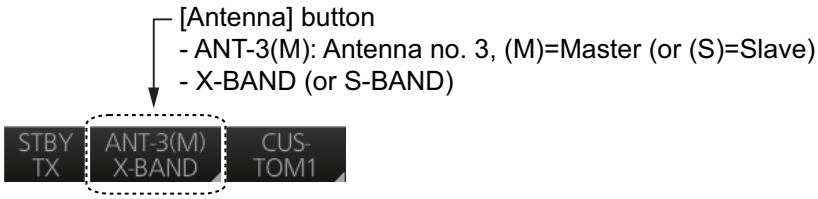
Note: Appropriate sensors are required to display any data. The wind vector shows a direction from which the wind blows in, relative to own ship heading, and is labeled "T *." Wind velocity is a true wind speed as a result of compensating for own ship's speed and orientation. Ocean current (tide) is shown relative to bow in head-up, cursor gyro and course-up, and reference to North in north-up and true motion.

2.28 Interswitch

The interswitch uses a network to transfer multiple radar signals to the monitor units connected in the network. A master/slave relation can be set for a single radar signal and that signal can be shown on multiple displays. Up to four antennas and four display units can be connected. Set the radar display and antenna groups from the [Antenna] button on the Status bar.

When you switch to a different antenna, the heading skew and timing adjustment (set at installation) for that antenna are automatically applied.

The [Antenna] button on the Status bar shows current antenna selection.

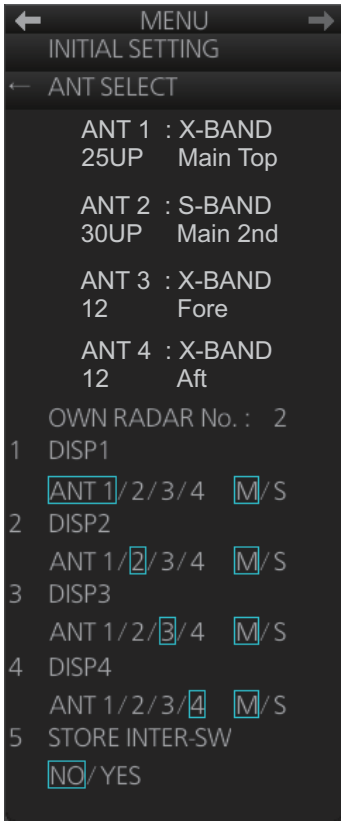


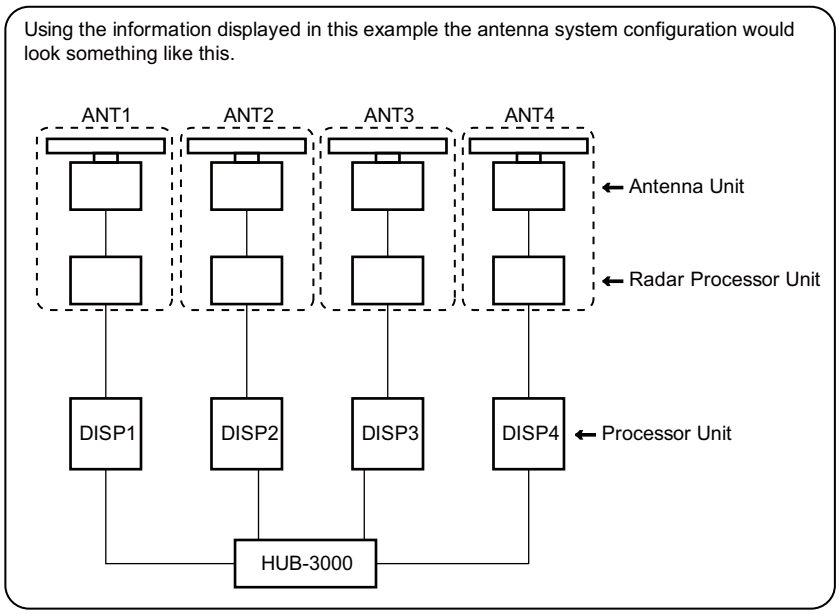
2.28.1 Displaying antenna information

The [ANT SELECT] display shows:

- Radar band, output power and antenna position of each antenna currently powered. (If an antenna is not powered, its data area is blank.)
- Current antenna and display combinations.

To show antenna information, open the menu then select the [8 INITIAL SETTING] and [5 ANT SELECT] menus.





2.28.2 How to preset antenna and display combinations

You can preset the antenna and display combinations for each antenna and display in the radar system. As an example, the procedure below shows how to select the no. 1 antenna unit for the no. 2 display unit.

1. Open the menu then select the [8 INITIAL SETTING] and [5 ANT SELECT] menus.
2. Select the display unit for which to select an antenna (at the next step). For example, select [DISP2] to select the no. 2 display unit.
3. Select [ANT1] and [M].
4. Repeat steps 2 and 3 to set other display and antenna combinations.
5. Click [STORE INT-SW] and select [YES] to save your selections.
6. Close the menu.

Antenna selection considerations

- An antenna unit cannot be controlled from multiple display units. Select one Master display unit for one antenna unit. If two antenna units are set as masters, the display last-set as master becomes the master and all other displays are automatically changed to slave.
- An antenna unit without a Master display cannot be selected on the sub display units. If there is no antenna unit set as master, the lowest number display is automatically set as master.
- Radar functions are controlled independently, dependently or commonly depending on selection as Master or Slave.

Radar Functions	Control	Master Display Option	Slave Display Option
AIS function	Independent	Desired value can be set	Desired value can be set
Brilliance	Independent	Desired value can be set	Desired value can be set
Echo trails	Independent	Desired value can be set	Desired value can be set
EBL	Independent	Desired value can be set	Desired value can be set
Lat/long data	Independent	Desired value can be set	Desired value can be set
Presentation mode	Independent	Desired value can be set	Desired value can be set
Speed data	Independent	Desired value can be set	Desired value can be set
TT, AIS on/off	Independent	Desired value can be set	Desired value can be set
TT, AIS track interval	Independent	Desired value can be set	Desired value can be set
Vector mode	Independent	Desired value can be set	Desired value can be set
Vector time	Independent	Desired value can be set	Desired value can be set
VRM	Independent	Desired value can be set	Desired value can be set
Range	Independent	Desired value can be set	Desired value can be set
Reference Point	Independent	Desired value can be set	Desired value can be set
(Sampling at Master)	Dependent control	Echo sampling at master range) Desired value can be set	
A/C SEA	Dependent control	Desired value can be set	Cannot control
A/C RAIN	Dependent control	Desired value can be set	Cannot control
Auto Rain	Dependent control	Desired value can be set	Cannot control
Gain	Dependent control	Desired value can be set	Cannot control
Echo stretch	Dependent control	Desired value can be set	Cannot control
Echo averaging	Dependent control	Desired value can be set	Cannot control
ER	Dependent control	Desired value can be set	Cannot control
Picture setting	Dependent control	Desired value can be set	Cannot control
STBY/TX	Dependent control	Desired value can be set	Cannot control
Tuning	Dependent control	Item commonly controlled	Cannot control
TT Lost alert	Common control	Item commonly controlled	Item commonly controlled
TT CPA/TCPA alert	Common control	Item commonly controlled	Item commonly controlled
TT ALARM ACK	Common control	Item commonly controlled	Item commonly controlled
TT acquire	Common control	Item commonly controlled	Item commonly controlled
TT/AIS AZ	Common control		Item commonly controlled

- If the Alert 750 “EXT Radar COM Error” appears, do one of the following as applicable:
  - If only your antenna is not displayed on the [ANT SELECT] display, the LAN line in the Processor Unit may be faulty. In this case, use the standalone mode.
  - If the antenna that was in use does not appear on the [ANT SELECT] display, the LAN line in other Processor Unit may be faulty. In this case, see the preceding page for how to select a different antenna unit.
- When the Network fails, the Interswitch does not work, but standalone operation is possible.

2.28.3 How to select an antenna

For the ship that carries multiple antennas, you can select the antenna to use. Click the [Antenna] button to select the antenna.

2.29 Performance Monitor

A performance monitor, installed in the antenna unit, is required for a radar installed on a vessel of 300 GT and upward engaged in international voyages. Two units are available:

X-band radar: PM-31 (9410 ± 45 MHz)
S-band radar: PM-51 (3050 ± 30 MHz)

How to activate, deactivate the performance monitor

To activate, deactivate the performance monitor, do the following:

1. Open the menu then select the [1 ECHO] menu. Select [6 PERFORMANCE MON] (B type) or [5 PERFORMANCE MON] (IMO and A types).
2. Select [OFF] or [ON] as appropriate.
3. Close the menu. The message "PM" appears in the message area when the performance monitor is active.

The radar is automatically set as follows when the performance monitor is activated.

Item	Setting at activation of PM	Adjustable while PM is active	Setting at deactivation of PM
CONDITION	Setting stored	No	Setting before activation
CUSTOMIZE ECHO	Grayed out, setting stored	No	Return to active display
EAV	OFF	No	Setting before activation
ES	OFF	No	Setting before activation
GAIN	70 *1	Yes*3	Setting before activation
IR	OFF	No	Setting before activation
LOW LEVEL ECHO	Setting stored	No	Setting before activation
NEAR STC CURVE MID STC CURVE FAR STC CURVE	Setting stored	No	Setting before activation
NOISE REJECT	OFF	No	Setting before activation
OFF center	OFF	Yes	Setting at deactivation
Presentation Mode	Setting stored *2	Yes	Setting at deactivation
PULSE	LONG	No	Setting before activation
QV ECHO LEVEL	Setting stored	Yes	Setting at deactivation
RAIN	0	No	Setting before activation
RAIN AUTO	MAN	No	Setting before activation

Item	Setting at activation of PM	Adjustable while PM is active	Setting at deactivation of PM
RANGE	24 NM, 24 SM, 48 km, 48 kyd	Yes *4	Setting at deactivation
SEA	0	No	Setting before activation
SEA AUTO	MAN	No	Setting before activation
STC RANGE	Setting stored	No	Setting at deactivation
TUNE	AUTO	No	Setting before activation
VIDEO CONTRAST	4B	No	Setting before activation
WIPER	OFF	No	Setting before activation

*1 Gain is automatically set according to [PM GAIN ADJUST] if it was adjusted at installation.

*2 North-up RM is selected when the mode is North-up TM.

*3 The setting is not memorized.

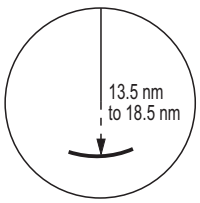
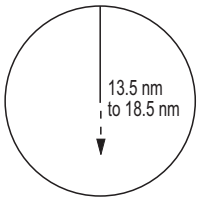
*4 The performance monitor is deactivated if the range is changed.

How to check radar performance

The range scale is automatically set to 24 nm. The radar screen will show one or two arcs. If the radar transmitter and receiver are in good working order in as much as the original state when the monitor was turned on, the innermost arc should appear between 13.5 and 18.5 nm. The performance monitor can observe a total of 10 dB loss in the transmitter and receiver.

Note: The lengths and location of the arcs may vary according to the direction in which the antenna unit is installed. Judge the strength of the echo that appears within 60° from arc location to confirm if the radar is working properly or not.

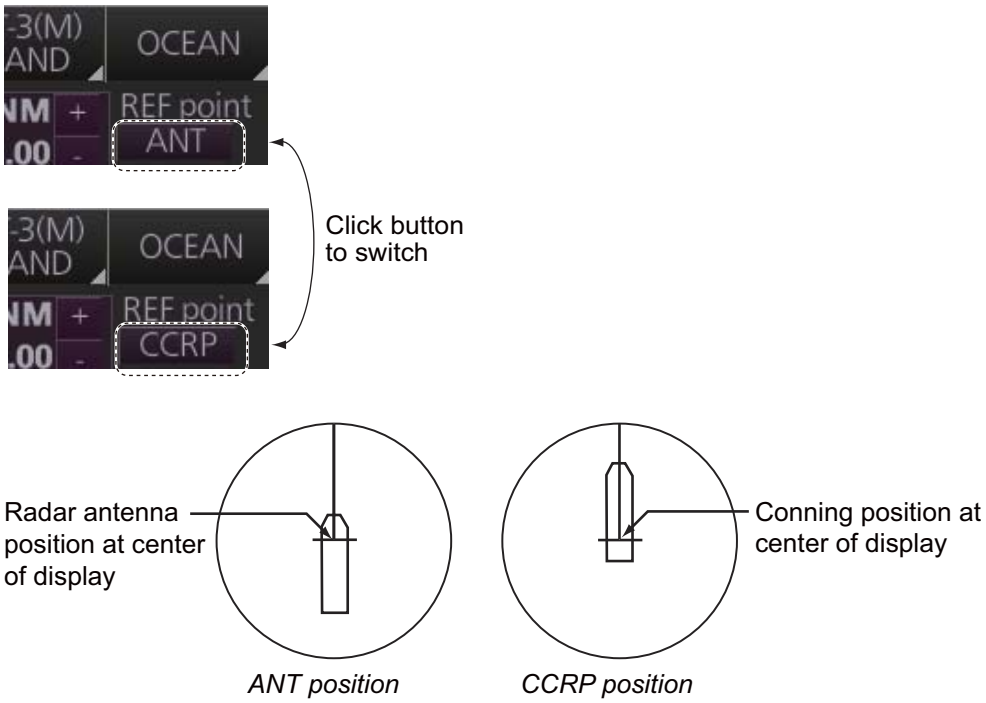
Turn off the performance monitor when finished.

Display	Transmitter, receiver state
	**Transmitter**: Normal **Receiver**: Normal
	**Transmitter and receiver**: No arc indicates 10 db loss. Have a technician check the magnetron.

2.30 CCRP (Common Consistent Reference Point)

The reference position for measurements (range, bearing, etc.) and markers (heading line, stern mark, etc.) can be antenna position or CCRP, which is a location on own ship to which all horizontal measurements, for example range, bearing, relative course, relative speed, closest point of approach (CPA) or time to closest point of approach (TCPA), are normally referenced.

To select the reference position, click the button below [REF point] at the top-left position to select [ANT] or [CCRP] as applicable.



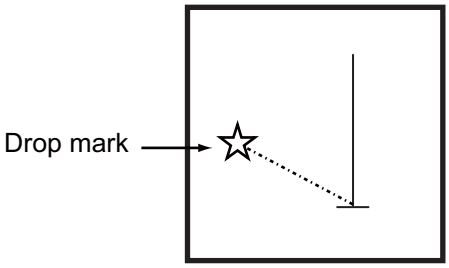
The position of the own ship marker changes according to reference position as shown on the next page. If the CCRP is positioned outside of the effective display area, the bearing scale is indicated with the appropriate reduced detail.

Range and bearing are measured and graphics are drawn according to reference point as shown in the table below.

Category	Item	Reference point	
		CCRP	Antenna position
Range and bearing measurement	EBL	Range and bearing measured from CCRP	Range and bearing measured from antenna position
	VRM		
	Cursor		
	PI line		
	Range ring		
	Drop mark		
Graphics	Heading line	Drawn from CCRP	Drawn from antenna position
	Stern mark		
	Beam line		
	Own ship vector		
	Own ship track		
Bearing cursor		Drawn with CCRP at center	Drawn with antenna position at center
Course, speed		Calculated with CCRP at center	Calculated with antenna position at center
CPA, TCPA		Calculated with CCRP at center	Calculated with antenna position at center
BCR, BCT		Calculated from bow position	
Own ship data	Heading	Data from sensor, regardless of reference point selected	
	Speed		
	Course over ground		
	Speed over ground		
	Own L/L		

2.31 Drop Mark

The drop mark is used to find the angle and distance from a point to your ship. This can be useful for marking a point to avoid while navigating to a destination. The drop marks can be shown or hidden on the screen.



The Drop mark box shows the angle and distance between the drop mark and your ship.

Note: The drop mark feature is inoperative when position data is lost.

2.31.1 How to show, hide the drop mark

Show, hide drop box from menu

1. Open the menu then select the [5 MAP MARK] and [1 MARK SETTING] menus.
2. Select [7 DROP MARK] (B type) or [6 DROP MARK] (IMO and A types).
3. Select [ON] or [OFF].
4. Close the menu.

Show, hide drop box by trackball

OFF: Click the arrow on the [Drop mark] box or right-click the box and select [DROPx OFF] (x=2 Drop mark no.)
ON: Click the minimize box.

2.31.2 How to inscribe a drop mark

Click the desired Drop mark box at the bottom of the screen. Click a position on the display area where to put a drop mark, and a drop mark is inscribed at the position selected. The angle and distance to the point appear in the corresponding Drop mark box.

2.31.3 Drop mark bearing reference

The bearing of a drop mark is automatically referenced to True or Relative according to the presentation mode.

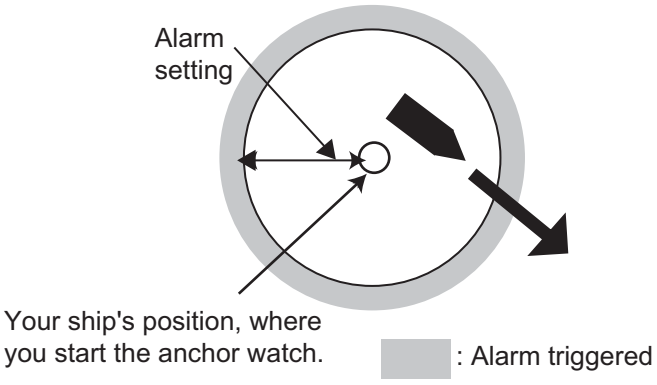
Presentation mode	Bearing reference
Head-up RM	Relative
Head-up TB RM	
Stern-up	
Course-up	True
North-up RM	
North-up TM	

2.31.4 How to erase a drop mark

Right-click the applicable Drop mark box to show the context-sensitive menu then select [Drop 1 Off] (or [Drop 2 Off]). The drop mark and its data are erased.

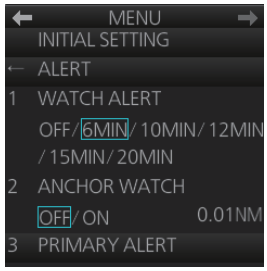
2.32 Anchor Watch

The anchor watch is used to monitor if the ship is staying at anchor. If your vessel travels more than the distance set here, the Alert 495 "Anchor Watch Error" appears in the [Alert] box and the audio alarm sounds.



How to activate anchor watch

1. Open the menu then select [8 INITIAL SETTING] and [4 ALERT] menus.
2. Select [3 ANCHOR WATCH].
3. Select [ON]. Use the scrollwheel to set the alarm radius (0.01 to 9.99 NM).
4. Close the menu.

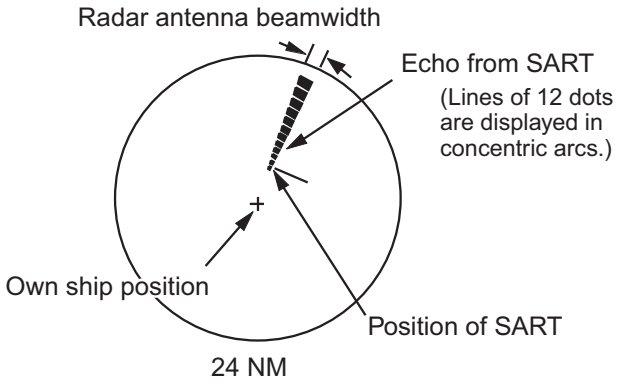


2.33 SART

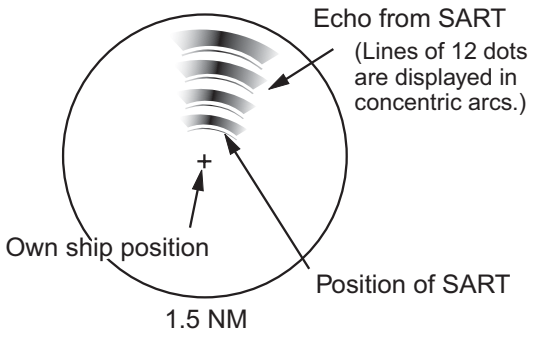
2.33.1 What is an SART?

A Search and Rescue Transponder (SART) may be triggered by any X-band (3 cm) radar within a range of approximately 8 nm. Each radar pulse received causes it to transmit a response which is swept repetitively across the complete radar frequency band.

Screen A: When SART is distant



Screen B: When SART is close



2.33.2 How to receive an SART

This radar is equipped with a feature that optimally sets up the radar for SART detection. This feature automatically detunes the radar receiver out of its best tuning condition. This erases or weakens all normal radar echoes, but the SART marks are not erased because the SART response signal scans over all frequencies in the 9 GHz band. When the radar approaches the SART in operation, the SART marks will enlarge to large arcs, blurring a large part of the screen.

1. Open the menu then select the [1 ECHO] menu.
2. Select [7 SART] (B type) or [6 SART] (IMO and A types).
3. Select [ON].
4. Close the menu. The message "SART" appears in the message area when the SART function is active.

When the SART is activated the radar controls are automatically set as follows.

Item	Setting at activation of SART feature	Adjustable during activation of SART feature	Setting at deactivation of SART feature
CONDITION	Setting stored	Yes	Setting at deactivation
CUSTOMIZE ECHO	Grayed out, setting stored	No	Return to active display
EAV	OFF	No	Setting before activation
ES	OFF	No	Setting before activation
GAIN	Setting stored	Yes	Setting at deactivation

Item	Setting at activation of SART feature	Adjustable during activation of SART feature	Setting at deactivation of SART feature
IR	OFF	No	Setting before activation
LOW LEVEL ECHO	Setting stored	Yes	Setting at deactivation
NEAR STC CURVE MID STC CURVE FAR STC CURVE	Setting stored	Yes	Setting at deactivation
NOISE REJECT	OFF	No	Setting before activation
OFF center	OFF	Yes	Setting at deactivation
Presentation Mode	Setting stored *1	Yes	Setting at deactivation
PULSE	LONG	No	Setting at deactivation
QV ECHO LEVEL	Setting stored	Yes	Setting at deactivation
RAIN	Setting stored	Yes	Setting at deactivation
RAIN AUTO	MAN	No	Setting before deactivation
RANGE	12 NM, 12 SM, 24 km, 24 kyd	Yes *2	Setting at deactivation
SEA	Setting stored	Yes	Setting at activation
SEA AUTO	Setting stored	Yes	Setting at deactivation
STC RANGE	Setting stored	Yes	Setting at deactivation
TUNE	Setting stored	Yes	Setting at deactivation
VIDEO CONTRAST	Setting stored	Yes	Setting at deactivation
WIPER	Setting stored	Yes	Setting at deactivation

*1 North-up RM selected when the mode is North-up TM.

*2 The SART feature is deactivated if the range is changed.

2.34 Alert Box, Alert List

2.34.1 Alert box

When an alert condition is found, the applicable alert message and alert ID appear in the [Alert] box. For the alarm- and warning-type alerts a buzzer sounds. The [Alert] box is composed of the four items shown in the figure below. See chapter 20 for details.

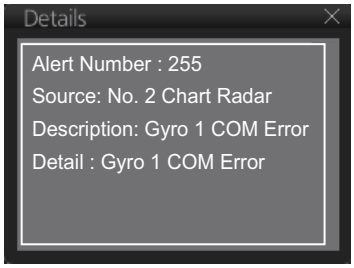
2.34.2 Alert list

The [Alert List] displays the status of the latest 900 system alerts, in order of generation, latest to the earliest. To display the list, click the Alert list/log icon in the [Alert] box. The Alert list/log icon is light-blue when the list is displayed. A maximum of nine alerts are shown per page. Unacknowledged alerts are displayed in flashing red (alarm) or flashing yellow-orange (warning). The ZDA sentence is required to display time in the list.

	Alert list item	Description
	CLOSE ("BACK" shown when there are two or more pages)	• Click to close list. (Press ← on the Control Unit to close list.) • Switch to preceding page in multiple page displays.
	NEXT (Not shown when only one page exists)	• The name of the alert not acknowledged or not rectified. • A maximum of nine alerts are displayed per page. • The list can be closed with the Close button (X). • An alert can be acknowledged and rectified from the list. **Control Unit**: Press appropriate numeric key. **Trackball module**: Click alarm name.

How to find details about an alert

Click the status icon in the list to show details about an alert.



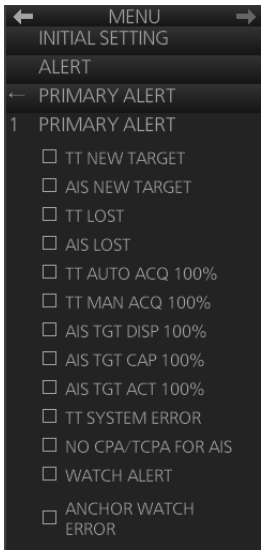
2.34.3 Changing priority of primary alerts

Alerts are categorized and prioritized as shown below.

Priority	Alert category
High	Alarm
Middle	Warning
Low	Caution

If desired, you can specify the events that are to have the same priority as “Alarm”.

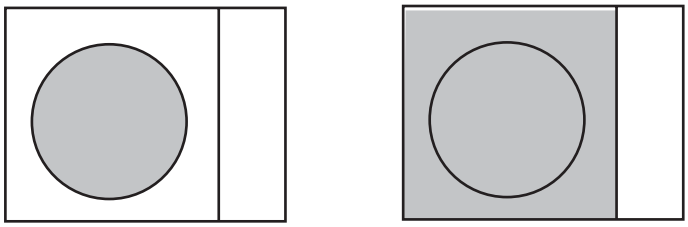
1. Open the menu then select the [8 INITIAL SETTINGS] and [4 ALERT] menus.
2. Select [3 PRIMARY ALERT].



3. Click the box to the left of an alarm name to show a circle to give that alarm the same priority as the alert category "Alarm."
4. Close the menu.

2.35 Echo Area

The echo display area for the B-type radar can be selected for [CIRCLE] or [WIDE].



CIRCLE WIDE

To select the echo display area type to use, open the menu, select the [1 ECHO] menu then set [2 ECHO AREA] to [CIRCLE] or [WIDE] as appropriate.

2.36 Echo Color

The default echo color is green. Echo color is also available in the following colors:

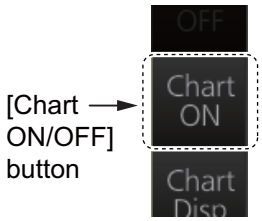
B type: Yellow, green, white, amber, and “color”. “Color” displays echoes in red, yellow or green corresponding to the signal levels of strong, medium and weak.
I**MO and A types**: Yellow, green and white.

To select the echo color, open the [1 ECHO] menu then select desired color from [3 ECHO COLOR] (B type) or [2 ECHO COLOR] (IMO and A types)

2.37 Chart Radar Functions

2.37.1 How to switch between radar and chart radar modes

Click the [CHART ON/OFF] button on the InstantAccess bar to show or hide the chart.



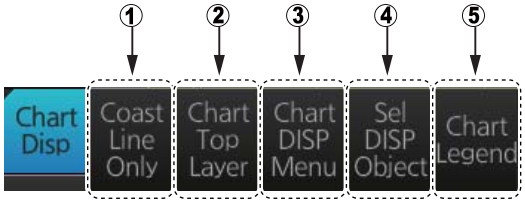
Indication on button and corresponding mode

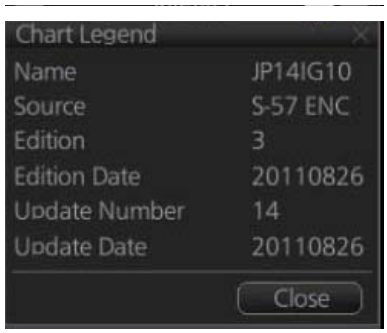
Chart ON: Chart radar mode active. (Chart and radar picture are displayed.)
Chart OFF: Radar mode active. (Only the radar picture is displayed.)

When the GPS position is lost, the chart radar mode cannot be used. When this occurs, the label on the button shows [Chart OFF] and the button is greyed out.

2.37.2 How to show or hide chart objects

The [Chart Disp] button on the InstantAccess bar has several buttons which control chart object visibility.



No.	Item	Function
1	Coast Line Only	Hold down the left button to temporarily display only the coast-line. Chart symbols (depth contours, navigation buoys, etc.) are temporarily erased from the screen.
2	Chart Top Layer	Hold down the left button to temporarily put the chart objects (buoy, lighthouse, etc.) on the top layer.
3	Chart DISP Menu	Show the [CHART DISPLAY] menu, where you set safety contours, safety depth, etc. See the figure on the next page for the content of this menu and see section 8.2 How to Control Visible Chart Objects for details. **Note:** This menu can also be shown by right-clicking the [CHART ON/OFF] button and selecting [Chart Display MENU].
4	Sel DISP Object	Show the [SEL DISP OBJECT] menu, where you can select the chart objects and text to show or hide. See the next page for the menus and see section 8.3 How to Control Visible Navigation Features (symbol display) for details.
5	Chart Legend	Show the chart legend for the current chart. See the chapters on Vector and C-MAP charts for a description of the chart legends. 

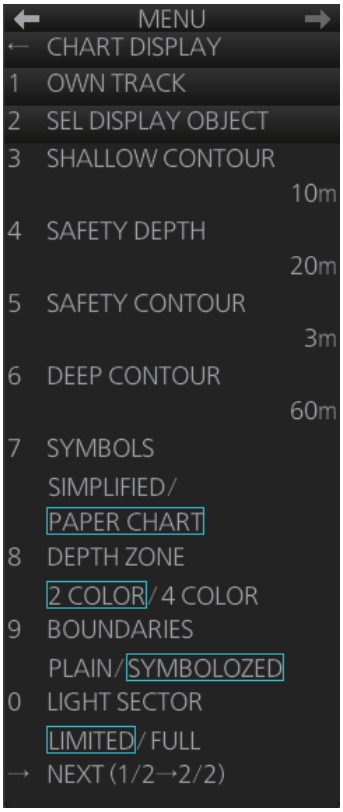
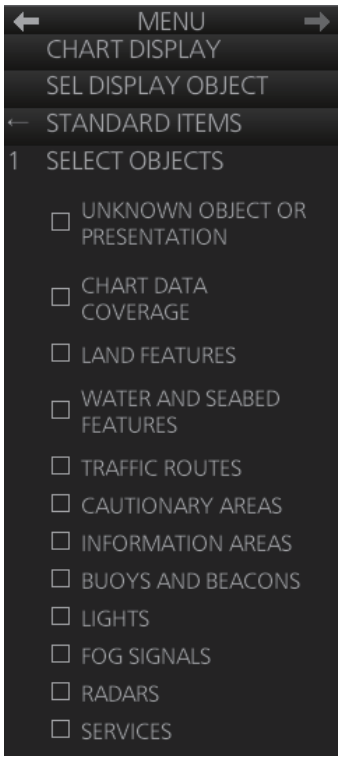
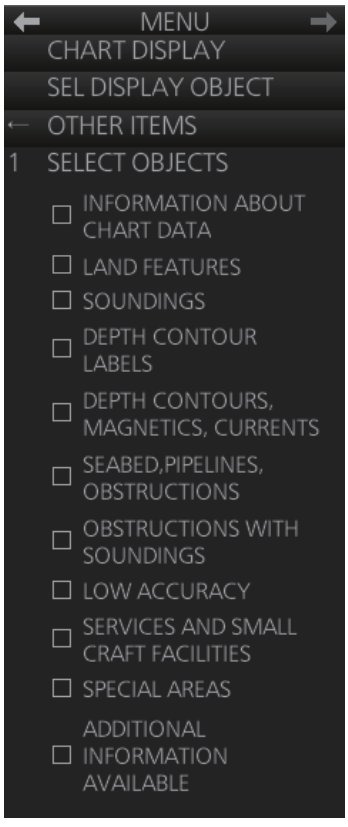


CHART DISPLAY menu



STANDARD ITEMS



OTHER ITEMS

OTHER TEXT

IMPORTANT TEXT

2.37.3 How to create and recall custom sets of chart display objects

You can create one custom set of chart display objects and recall them when required. For example, you can create a custom set of chart display objects to display when you navigate a certain coastline.

How to create a custom set of chart display objects

1. Open the menu then select the [6 CHART DISPLAY] and [SEL DISPLAY OBJECT] menus.
2. Open the [STANDARD ITEMS], [OTHER ITEMS], [IMPORTANT TEXT] and [OTHER TEXT] menus and turn objects and text on or off as appropriate.
3. Click [SEL DISPLAY OBJECT] on the menu.
4. Select [1 SAVE TO PERSONAL] to save the settings.
5. You are asked if it is OK to overwrite personal settings; click the [OK] button to save the settings.

How to activate the custom set of chart display objects

Click the [Chart database] button (see the illustration below) on the Status bar then select [PERSONAL].

2.37.4 Chart database information

You can select the quantity of objects and text to display on the chart radar screen, with the [Chart database] button on the Status bar. There are four different pre-defined settings available and one user-definable ([PERSONAL]). Indication of selected setting appears on the label of the [Chart database] button. The [Chart ON/OFF] button (on the InstantAccess bar) must be ON to show the [Chart database] button. The [Chart database] button is grayed out if the [Chart ON/OFF] button is OFF.

[Chart database] button	Selection	Setting in [SEL DISP OBJECT] menu
	IMO Base	Nothing checked in [STANDARD ITEMS], [OTHER ITEMS] or [IMPORTANT TEXT].
	IMO Primary	Nothing else checked but "Buoys and Beacons" in [STANDARD ITEMS]. This is the "Primary Chart Information Set (PCIS)", based on IEC 62388 section11.1.4.1, IEC61174 and IMO Resolution A.817(19).
	IMO Standard	All objects checked in [STANDARD ITEMS]; nothing checked in [OTHER ITEMS] or [IMPORTANT TEXT].
	IMO All	Everything checked in [STANDARD ITEMS], [OTHER ITEMS] and [IMPORTANT TEXT].
	PERSONAL	Use the settings recorded for [STANDARD ITEMS], [OTHER ITEMS], [IMPORTANT TEXT] and [OTHER TEXT].

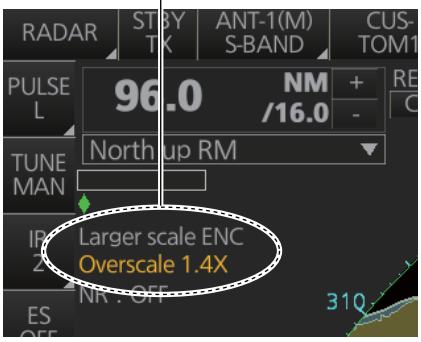
2.37.5 Chart scale indications

The system alerts you to the availability of larger scale ENC and overscale, at the top-left position.

When the radar display range is higher than the chart scale of the ENC chart, the indication, "Larger scale ENC" is displayed. For example, the radar range is 24 NM and the range available with the ENC chart is less than 12 NM.

When the radar display range is lower than the chart scale of the ENC chart, the indication "Overscale x.xx" (x.xx=overscale factor). For example, the radar range is 0.25 NM and the chart scale is 0.5 NM.

Location of chart scale indications



If both conditions exist, both indications are displayed.

2.37.6 Chart status

The indication "Chart status" appears at the top-right position on the screen when the display date for the currently displayed chart has passed.

2.37.7 Chart alert function

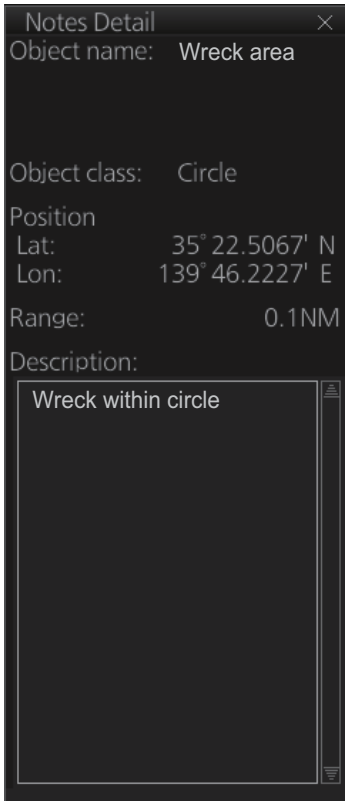
The chart alert function operates in chart mode only. There are two types of chart alerts: your ship's predicted course, and route alert. See the chapter on chart alerts for details.

For the ship's predicted course alert, the operator sets a safety contour. (See section 8.2.1 for how to set a safety contour suitable for the ship.) The operator also sets the parameters for own ship predicted movement. (See section 11.2 How to Activate Own Ship Check.)

For the route alert, route planning (see section 12.3 How to Create a New Route) and route monitoring (see section 14.1 How to Select the Route to Monitor) functions are available.

2.37.8 Notes details

"Notes" provides messages for the operator relative to a specific ship position. The chart radar compares the Notes position and own ship position and displays the Notes when own ship is at the distance from the Notes specified in route planning. To display the Notes at other times, right-click the display area to show the context-sensitive menu, then select [Notes details]. In the example below the Notes about a wreck are shown.



- **Object name**: The name assigned to the Notes.
- **Object class**: The type of object (point, line, area or circle) linked to the Notes.
- **Position**: Position of the object in latitude and longitude.
- **Range**: The range to the object.
- **Description**: A description of the object, input in the Voyage planning mode.

2.38 Radar Observation

2.38.1 General

Minimum range

The minimum range is defined by the shortest distance at which, using a scale of 1.5 or 0.75 nm, a target having an echoing area of 10 m^2 is still shown separate from the point representing the antenna position.

It is mainly dependent on the pulse length, antenna height, and signal processing such as main bang suppression and digital quantization. It is a good practice to use a shorter range scale as far as it gives favorable definition or clarity of picture. The IMO Resolution MSC.64(67) Annex 4 (Shipborne radar) and A.820: 1995 (High Speed Craft Radar) require the minimum range to be less than 50 m and 35 m, respectively. This series of radars satisfy this requirement.

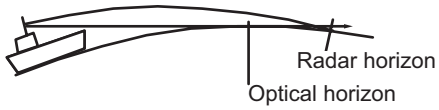
Maximum range

The maximum detecting range of the radar, R_{max}, varies considerably depending on several factors such as the height of the antenna above the waterline, the height of the target above the sea, the size, shape and material of the target, and the atmospheric conditions.

Under normal atmospheric conditions, the maximum range is equal to the radar horizon or a little shorter. The radar horizon is longer than the optical one by about 6% because of the diffraction property of the radar signal. The R_{max} is given in the following equation.

$$R_{max} = 2.2 \times (\sqrt{h1} + \sqrt{h2})$$

where Rmax: radar horizon (nm)
h1: antenna height (m)
h2: target height (m)



For example, if the height of the antenna above the waterline is 9 meters and the height of the target is 16 meters, the maximum radar range is;

$$R_{max} = 2.2 \times (\sqrt{9} + \sqrt{16}) = 2.2 \times (3 + 4) = 15.4 \text{ nm}$$

It should be noted that the detection range is reduced by precipitation (which absorbs the radar signal).

X-band and S-band
In fair weather, the equation on the previous page does not give a significant difference between X- and S-band radars. However, in heavy precipitation condition, an S-band radar would have better detection than an X-band radar.

Radar resolution
There are two important factors in radar resolution (discrimination): bearing resolution and range resolution.

Bearing resolution

Bearing resolution is the ability of the radar to display as separate pips the echoes received from two targets which are at the same range and close together. It is proportional to the antenna length and reciprocally proportional to the wavelength. The length of the antenna radiator should be chosen for a bearing resolution better than 2.5° (IMO Resolution). This condition is normally satisfied with a radiator of 1.2 m (4 ft) or longer in the X-band. The S-band radar requires a radiator of about 12 feet (3.6 m) or longer.

Range resolution

Range resolution is the ability to display as separate pips the echoes received from two targets which are on the same bearing and close to each other. This is determined by pulse length only. Practically, a 0.08 microsecond pulse offers the discrimination better than 35 m as do so with all FURUNO radars. Test targets for determining the range and bearing resolution are radar reflectors having an echoing area of 10 m^2.

Bearing accuracy

One of the most important features of the radar is how accurately the bearing of a target can be measured. The accuracy of bearing measurement basically depends on the narrowness of the radar beam. However, the bearing is usually taken relative to the ship's heading, and thus, proper adjustment of the heading line at installation is an important factor in ensuring bearing accuracy. To minimize error when measuring the bearing of a target, put the target echo at the extreme position on the screen by selecting a suitable range.

Range measurement

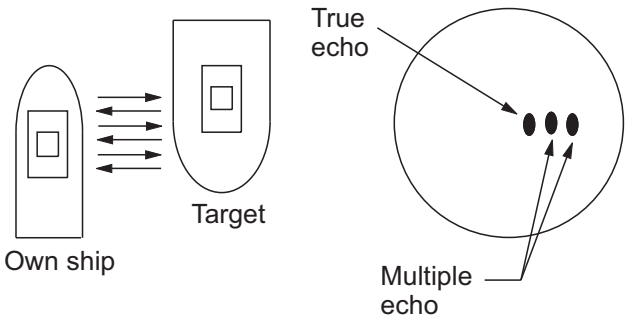
Measurement of the range to a target is also a very important function of the radar. Generally, there are two means of measuring range: the fixed range rings and the variable range marker (VRM). The fixed range rings appear on the screen with a predetermined interval and provide a rough estimate of the range to a target. The variable range marker's diameter is increased or decreased so that the marker touches the inner edge of the target, allowing the operator to obtain more accurate range measurements.

2.38.2 False echoes

Occasionally echo signals appear on the screen at positions where there is no target or disappear even if there are targets. They are, however, recognized if you understand the reason why they are displayed. Typical false echoes are shown below.

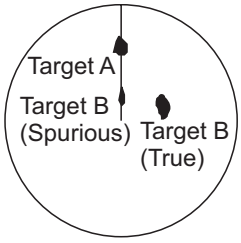
Multiple echoes

Multiple echoes occur when a transmitted pulse returns from a solid object like a large ship, bridge, or breakwater. A second, a third or more echoes may be observed on the display at double, triple or other multiples of the actual range of the target as shown below. Multiple reflection echoes can be reduced and often removed by decreasing the gain (sensitivity) or properly adjusting the sea clutter.



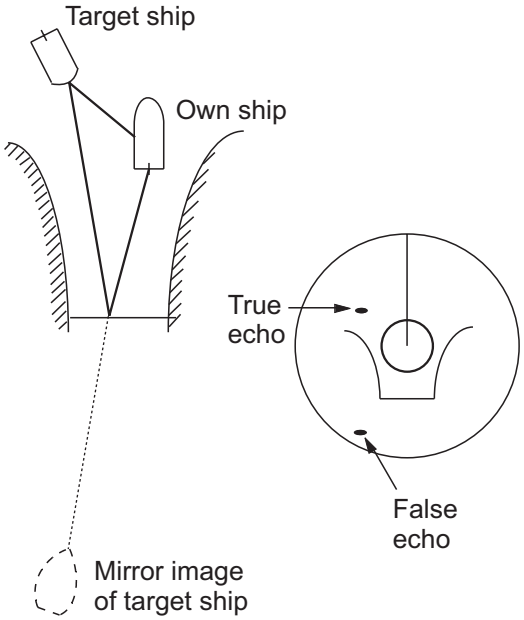
Sidelobe echoes

Every time the radar pulse is transmitted, some radiation escapes on each side of the beam, called "sidelobes." If a target exists where it can be detected by the side lobes as well as the main lobe, the side echoes may be represented on both sides of the true echo at the same range. Side lobes show usually only on short ranges and from strong targets. They can be reduced through careful reduction of the gain or sea clutter.



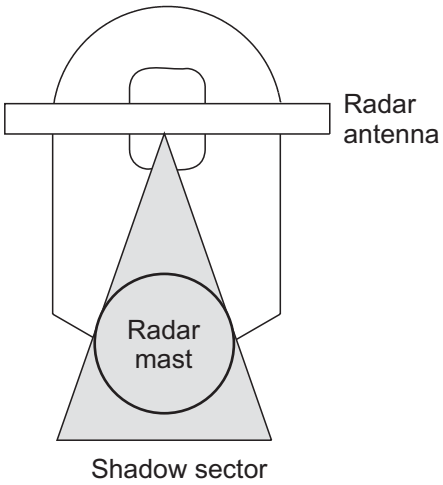
Virtual image

A relatively large target close to your ship may be represented at two positions on the screen. One of them is the true echo directly reflected by the target and the other is a false echo which is caused by the mirror effect of a large object on or close to your ship as shown in the figure below. If your ship comes close to a large metal bridge, for example, such a false echo may temporarily be seen on the screen.



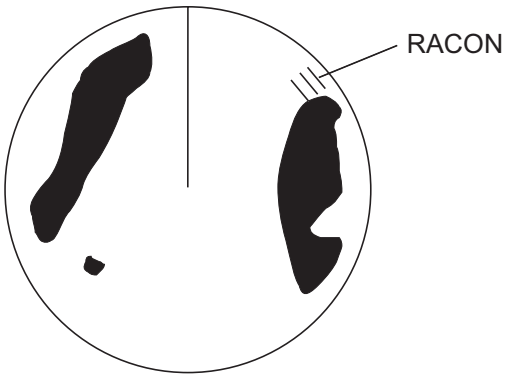
Shadow sectors

Funnels, stacks, masts, or derricks in the path of the antenna block the radar beam. If the angle subtended at the antenna is more than a few degrees, a non-detecting sector may be produced. Within this sector targets can not be detected.



2.38.3 RACON

A RACON is a radar beacon which emits radar receivable signals in the radar frequency spectrum (X- or S-band). There are several signal formats; in general, the RACON signal appears on the radar screen as a rectangular echo originating at a point just beyond the position of the radar beacon. It has a Morse coded pattern. Note that the position on the radar display is not accurate.



2.38.4 Radar Target Enhancer (RTE)

An RTE is a radar transponder that is mounted on navigation buoys and masts of small crafts to significantly improve their detection by radar. Unlike a SART or RACON, which are passive, the RTE receives a radar signal, amplifies it and re-transmits it, with the intention of making the target's signal look larger on a radar display. The RTE can be detected on both X-band and S-band radars.

3. TARGET TRACKING (TT)

3.1 About TT

The TT tracks and plots the movement of up to 100 radar targets and fully complies with IMO standards for TT.

The TT automatically tracks an automatically or manually acquired radar target and calculates its course and speed, indicating them with a vector. Since the data generated by the TT depends on the radar targets selected, the radar must be optimally tuned for use with the TT, to ensure required targets will not be lost or unnecessary targets like sea returns and noise will not be acquired and tracked.

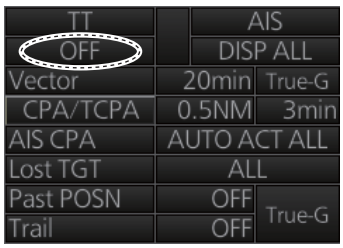
Tracking accuracy is affected by course change. One to two minutes is required to restore vectors to full accuracy after an abrupt course change. (The actual amount depends on gyrocompass specifications.)

The amount of tracking delay is inversely proportional to the relative speed of the target. Delay is approx. 15-30 seconds for the higher relative speed; approx. 30-60 seconds for the lower relative speed. The following factors can affect accuracy:

- Echo intensity
- Radar transmission pulse length
- Radar bearing error
- Gyrocompass error
- Course change (own ship and targets)

3.2 How to Show, Hide the TT Display

Click the TT mode indication at the bottom-right position to show [OFF] to hide the TT display, or [AUTO]*, [MAN]* or [MAN/AUTO]* to show the TT display. You can right-click the TT mode indication to show a context-sensitive menu with the choices shown above. In this case, click the applicable option.



* The indication shown depends on the setting of [TT SELECT] in the [TT AIS] menu.

3.3 How to Input Your Ship's Speed

The TT requires own ship's speed and heading data. The speed can be STW, SOG, or echo-referenced speed (based on 3 max. stationary objects) taken from this radar. Manual input is also possible.

For automatic or manual speed input, see section 1.14. For echo-referenced speed input see the next section.

3.3.1 Echo-referenced speed input

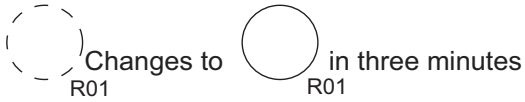
The use of echo-referenced speed is recommended when:

- The speed log is not operating properly or not connected to the radar.
- The vessel has no device that can measure ship's leeward movement (Doppler sonar, speed log, etc.) when leeward movement cannot be disregarded.

If you select echo-referenced speed, the TT calculates own ship's speed relative to a fixed reference target. The number of targets may be 1, 2 or 3. They appear as tracked targets, each denoted with a small circle. When a plural number of objects are selected, the mean value is used.

Note: This feature is not available when the AIS is active.

1. RIght-click the display area to show the context-sensitive menu then select [REF Mark].
2. Select a small fixed island or any radar prominent point located at 0.1 to 24 nm from own ship.
3. Use the trackball to put the cursor (+) on the target selected at step 2.
4. Push the left button to insert the reference mark.



5. Repeat steps 2-4 to continue entering reference marks. Three may be entered.
6. Right click the Sensor information box then choose [Select Sensor] and [Setting]. Open the [SPD] page and put a checkmark at [Reference SPD]. Click the [OK] button to finish.

Notes on speed input by reference target

- Reference targets are only used for the calculation of true speed.
- Do not use reference target generated true speed to calculate relative speed. Relative speed data is not accurate because response to speed change is slow, hampering the TT's ability to accurately judge the possibility of collision.
- Select a stationary target as a reference target to calculate own ship speed as ground tracking speed. Do not choose a moving target as a reference target. A moving target produces error in the vector for TT and AIS, which results in wrong collision avoidance information. Further, an unstable stationary target produces inaccurate speed data and the target itself may become lost.
- When a reference target is lost or goes out of the acquisition range, the reference target mark flashes and the Alert 528 "REF Target Lost" appears in the [Alert] box.

If all reference targets are lost, the speed indication disappears. Select a different reference target if the currently selected one is lost.

- When all tracked targets are deleted, the reference target mark is also deleted and the target-based speed becomes invalid.
- Loss of reference target will affect the calculation of true speed and true course of targets. Further, own ship speed will be inaccurate.

Canceling echo-referenced speed input

Right click the Sensor information box then choose [Select Sensor] and [Setting]. Open the [SPD] page and select a speed sensor.

3.4 Automatic Acquisition

This radar can acquire and track a maximum of 100 targets. The number of automatically and manually acquired targets is determined by the setting of [TT SELECT] in the [TT] menu.

[TT SELECT] setting and target acquisition condition

Menu setting	Acquisition condition
MANUAL 100	100 targets manually
AUTO 25	25 targets automatically, 75 targets manually
AUTO 50	50 targets automatically, 50 targets manually
AUTO 75	75 targets automatically, 25 targets manually
AUTO 100	100 targets automatically

A target just acquired automatically is marked with a dashed circle and a vector appears within one minute to indicate the target's motion trend. Within three minutes, the initial tracking stage is finished and the target becomes ready for stable tracking. At this time, the dashed circle changes to a solid circle.

3.4.1 How to enable auto acquisition

1. Right-click the TT mode indication then select [TT Menu] to show the [TT] menu.
2. Select [1 TT SELECT] and the acquisition condition - [MANUAL 100], [AUTO 25], [AUTO 50], [AUTO 75] or [AUTO 100].
3. Close the menu.

Note 1: The TT indication in the TT/AIS information box shows [AUTO], [MAN/AUTO] or [MAN] depending on the acquisition condition selected.

Note 2: When the menu-set number of automatically acquired targets have been acquired, the Alert 523 "TT Auto ACQ 100%" appears in the [Alert] box.

Note 3: Targets cannot be acquired manually using the acquisition condition "AUTO 100". Also, you cannot acquire targets automatically in the acquisition condition "MAN 100".

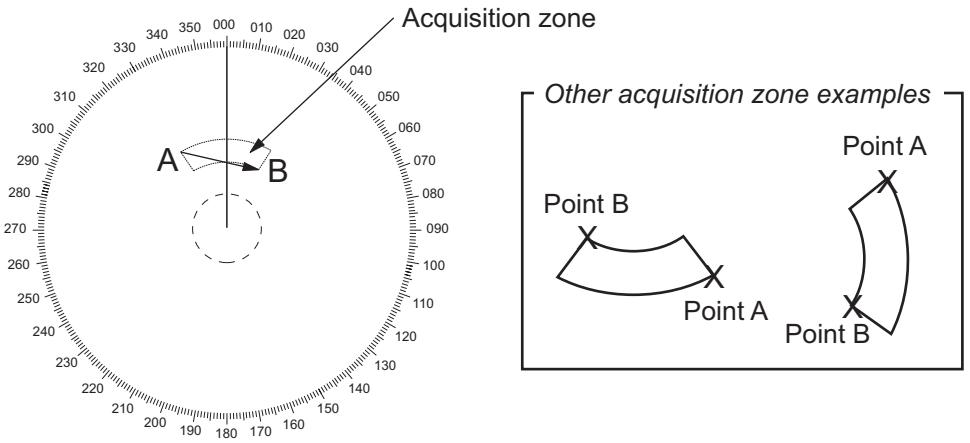
3.4.2 How to set an automatic acquisition zone

You can set an automatic acquisition zone to automatically track any targets entering the zone. The acquisition zone can be fan-shaped or polygonal. For the fan-shaped zone, the range is fixed at a 3-6 NM (width 0.5-1.0 NM). The polygon zone can be set within the range of 0.125 NM to 120 NM. (However, automatic acquisition occurs only between 0.1 to 24 NM (or 32 NM)). The maximum tracking range is set during the installation.

When a target enters an acquisition zone, the following occurs:

- the buzzer sounds
- the Alert 521 "TT New Target" appears in the [Alert] box
- the symbol of the target is red and flashes
- the AIS function is automatically turned on if it is off

1. Click one of the boxes AZ1 or AZ2 at the right side of the screen. "AZx SET" (x=1 or 2) appears in the box.
2. Click point A.
3. Click point B. The box now shows "AZx WORK".



Note 1: You are alerted when the capacity for automatic acquisition is 95% and 100%. These alerts are 522 "TT Auto ACQ 95%" and 523 "TT Auto ACQ 100%".

Note 2: If the range scale is changed to less than half of the acquisition zone, the AZ box shows "OUT." If the left button is pushed in this state, the acquisition alarm zone goes into "sleep" state (inactive).

How to sleep, deactivate an acquisition zone

Use the trackball to select the appropriate AZ box. Sleep or deactivate the acquisition zone as appropriate:
Sleep acquisition zone: Push the left button momentarily to remove the acquisition zone from the screen. The indication in the AZ box changes from "WORK" to "SLEEP." To reactivate and display the acquisition zone, repeat this procedure to display "WORK."
Deactivate acquisition zone: Click applicable AZ box and select [Off].

How to acknowledge the acquisition zone audio alarm

Press the **ALARM ACK** key, or click the [Alert] box.

Acquisition zone stabilization

The acquisition zone may be referenced to heading or North. Open the menu then select the [TT/AIS] and [1 ACQUISITION ZONE] menus. Set [1 AZ STAB] to [STAB HDG] or [STAB NORTH] as appropriate. For a polygon acquisition zone, stabilization can be selected to [AZ POLYGON].

3.5 Manual Acquisition

A maximum of 100 targets may be acquired manually depending on the acquisition condition set on the [TT SELECT] menu.

Note: Targets cannot be acquired manually using acquisition condition "AUTO 100". Also, you cannot acquire targets automatically in acquisition condition "MAN 100".

3.5.1 How to set manual acquisition conditions

1. Open the menu then select the [2 TT/AIS], [3 TT] and [1 TT SELECT] menus.
2. Select desired manual acquisition condition, among [MANUAL 100], [AUTO 25], [AUTO 50] and [AUTO 75].
3. Close the menu.

3.5.2 How to manually acquire a target

Acquire a target from the Control Unit

Use the trackball to put the cursor on the target you want to acquire. Push the **ACQ/ACT** key.

Acquire a target by the trackball module

1. Put the cursor on the target to acquire.
2. Push the right button to show the context-sensitive menu then select [Target Data/ACQ/ACT] to acquire the target.

The plotting symbol is drawn by a dashed circle during the initial acquisition stage. A vector appears approximately one minute after acquisition. The vector indicates the motion trend of the target. If the target is consistently detected for three minutes, the plotting symbol changes to a solid circle. If acquisition fails, the target symbol blinks.

Note 1: For successful acquisition, the target should be within 0.2 to 24 nm (or 32 nm, depending on initial setting) from own ship and not obscured by sea or rain clutter.

Note 2: You are alerted when the capacity of manual acquisition is 95% and 100%. These alerts are Alert 524 "TT MAN ACQ 95%" and Alert 525 "TT MAN ACQ 100%". If the capacity is 100% you cannot acquire more targets. Cancel tracking of non-threatening targets if you wish to acquire additional targets manually.

Note 3: When a target being tracked nears another target being tracked, the targets may be "swapped". When two targets acquired either automatically or manually come close to each other, one of the two may become a lost target. If this occurs, manual re-acquisition of the lost target may be necessary after the two have separated.

Note 4: You can reuse a target number. This is useful when you acquire the “wrong” target. Drag and drop the symbol onto the correct target.

3.6 How to Terminate Tracking of Targets (including reference targets)

When the TT has acquired the menu-set number of targets, the Alert 523 "TT AUTO ACQ 100%" (automatic acquisition) or "525 TT MAN ACQ 100%" (manual acquisition) appears in the [Alert] box and no more auto or manual acquisition occurs unless targets are lost. Should this happen, cancel tracking of less important targets to acquire new targets.

3.6.1 How to cancel tracking on individual tracked targets

Cancel tracking on a target from the Control Unit

1. Use the trackball to put the cursor (+) on the TT or reference target to cancel tracking.
2. Push the **TARGET CANCEL** key.

Cancel tracking on a target by the trackball module

1. Right-click the target to show the context-sensitive menu.
2. Select [Target Cancel] then push the left button.

3.6.2 How to cancel tracking on all TTs

1. Right-click the TT mode indication then select [TT Menu] to show the [TT] menu.
2. Select [2 ALL CANCEL].
3. Close the menu.

3.7 TT Symbols and TT Symbol Attributes

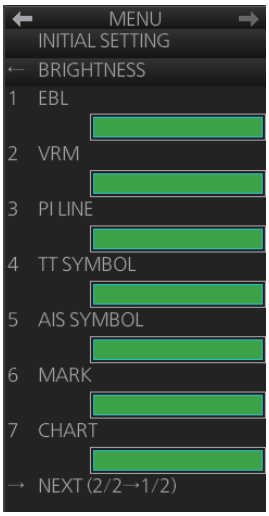
3.7.1 TT symbols

The symbols used in this equipment comply with IEC 62388.

Symbol	Default color	Name	Description
	Green	Past position marker	Past position point
	Green	Target under acquisition	Plotting symbol selected for a target acquired manually is shown in broken lines.
	Red	Target under automatic acquisition	Thick, broken circle around an echo to indicate the target under acquisition and initial stage of tracking, before steady-state tracking.
	Green	Acquired target	Solid circle with vector indicating steady state tracking (within three minutes after acquisition)
	Red	ACQed target in ACQ zone (before acknowledgement)	Thick, solid circle with vector indicating steady state tracking (within three minutes after acquisition)
	Red	Dangerous target	Dangerous TT (thick, solid circle)
 R01	Green	Reference target	Used to calculate own ship's over-the-ground speed (echo-referenced speed) for ground stabilization.
	Green	Association target	
	Red	Association dangerous target	
	Red	Lost target	
	Green	Target selected	TT selected to show its data.
T	White	Trial maneuver	Displayed (flashing) during trial maneuver test.
S	White	TT test	Displayed (flashing) during TT test.

3.7.2 TT symbol brilliance

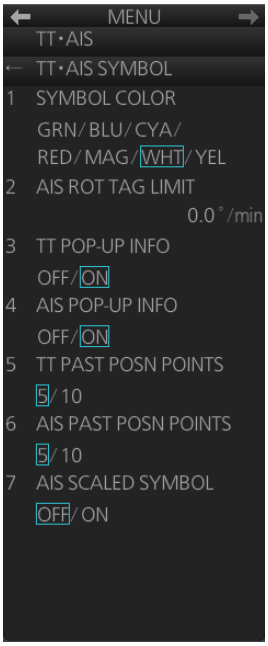
1. Right-click the [BRILL] button on the InstantAccess bar then select [BRILL menu].
2. Go to page 2, select [TT SYMBOL] then spin the scrollwheel to adjust the brilliance.



3.7.3 Color for TT symbol

You can select the color for the TT symbol as follows:

1. Right-click the TT mode indication then select [Symbol Menu] to show that menu.



2. Select [1 SYMBOL COLOR] and desired color. (Red and yellow are available with the A-and B-type.)

3.8 How to Display TT Data

3.8.1 How to display target data for individual TT

You can show the data for two (19-inch display) or three (23-inch display) tracked targets in the TT information window.

By Control Unit

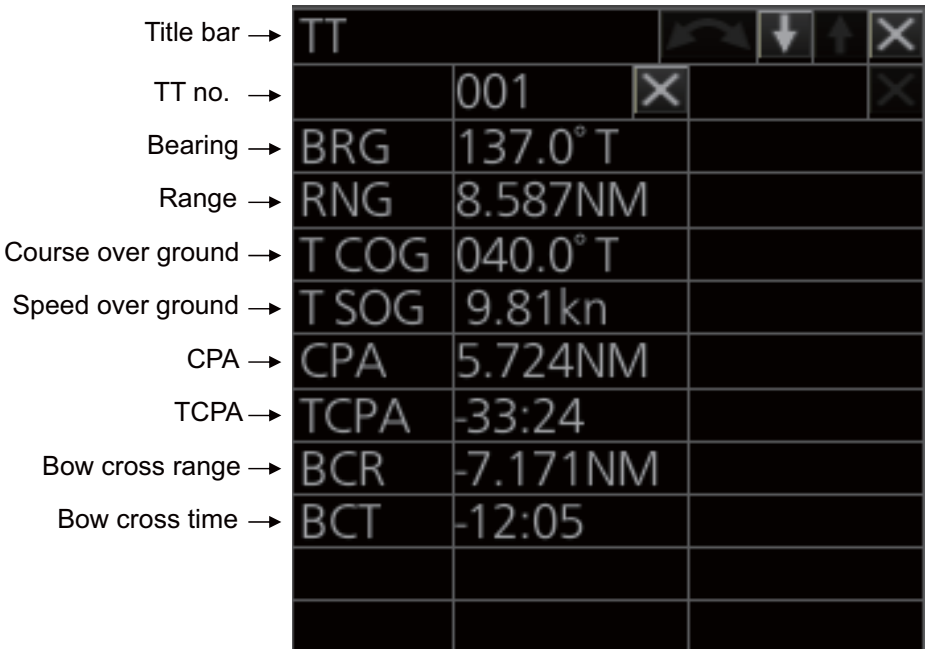
Put the cursor on a target then push the **TARGET DATA** key.

By trackball

Click the target for which you want to show its data.

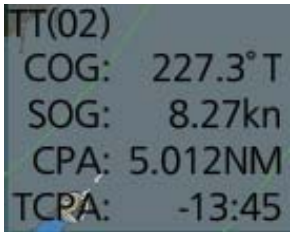
Tracked target data

- To erase data from a data box, click the appropriate close data button.
- The basic target data display for a TT consists of the following information:
  - TT no. Target numbering starts from "1". When a target is erased the number will not be reused until the power is re-set or more than 100 targets are acquired.
  - Bearing (BRG) and distance (RNG) of the target from own ship
  - True speed over the ground (SOG) and true course over the ground (COG) of the target
  - CPA and TCPA. A negative TCPA value means that you have already passed the closest point and the TT is going away from own ship.
  - Bow Closest Range (BCR) and Bow Closest Time (BCT)



3.8.2 TT pop-up information

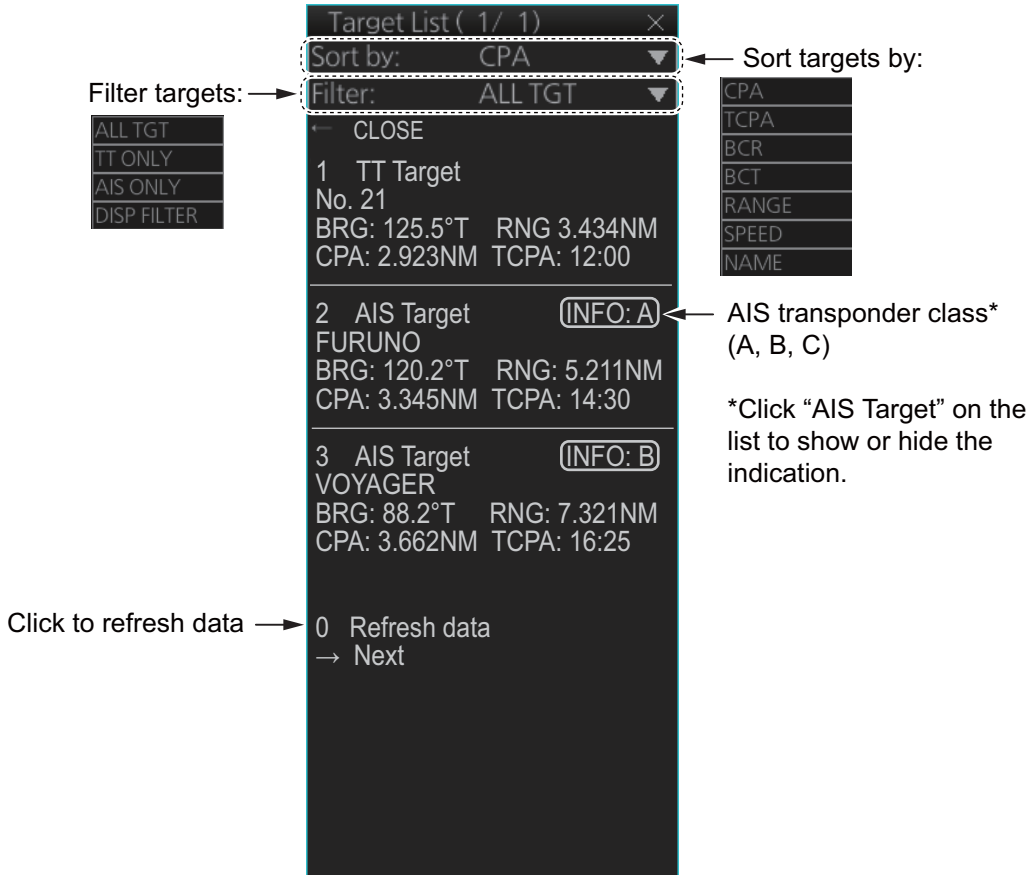
The TT pop-up shows abbreviated TT data (target no., COG, SOG, CPA and TCPA) for the selected TT. Simply put the cursor on the TT symbol to show the pop-up. The pop-up can be enabled or disabled with [TT POP-UP INFO] in the [TT/AIS SYMBOL] menu.



3.8.3 Target list

The target list shows the data for all tracked targets and AIS targets. To show the list, click the [Target List] button at the right side of the screen or press the **TARGET LIST** key on the Control Unit. (The button is light-blue when the target list is displayed.)

To close the list, click the Close button (X) on the list or press the **TARGET LIST** key.



How to sort the list

You can sort the list by CPA, TCPA, BCR, BCT, RANGE, SPEED or NAME, with the [Sort by] drop-down list.

How to filter the list

The list shows all tracked targets and AIS targets received. If you do not need to see all targets you can filter unnecessary ones. Use the [Filter] drop-down list to select what targets to filter: Show all targets, TT only, AIS targets only, or show only the AIS targets that meet the criteria set on the [DISP FILTER] menu.

3.9 Vector Modes

Target vectors can be displayed relative to own ship's heading (Relative) or North (True).

Note: IMO recommends the use of the true vector mode in sea stabilization or relative vector mode for collision avoidance.

3.9.1 Description of vectors

Ground stabilization and sea stabilization

[SPD][System Sensor Settings][Local System Settings][Bottom][Water][True-G][True-S].

Target vectors can be ground stabilized or sea stabilized in the True Motion mode. To select speed over the ground or speed through the water data, open the page from the or menu. Select for ground stabilization or for sea stabilization. The Vector mode indication shows the stabilization mode in the true motion as [True-G] or [True-S].

Sea stabilization is a mode where own ship and all targets are referenced to the sea using a compass heading and single-axis log water speed inputs in the true motion mode. Ground stabilization is a mode where own ship and all targets are referenced to the ground using the ground track or set and drift inputs. If the accuracy seems unsatisfactory, enter set and drift corrections. Note that set and drift should not be used when the radar is displaying AIS targets.

True vector

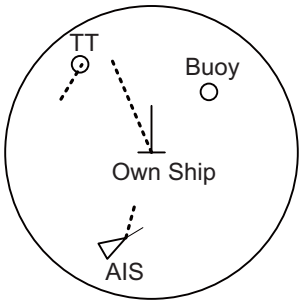
In the true motion mode, all fixed targets such as land, navigational marks and ships at anchor remain stationary on the radar screen with vector length zero. But in the presence of wind and/or current, the vectors appear on fixed targets representing the reciprocal of set and drift affecting own ship unless set and drift values are properly entered.

In the true vector mode, there are two types of stabilization: ground stabilization (True-G) and sea stabilization (True-S). The stabilization mode is automatically selected according to speed selection, as shown in the table on the next page. Manual selection is available with [Stabilization Mode] in the [SPD] page in the [Sensor Settings] menu. [Bottom], [True-G], [Water], [True-S].

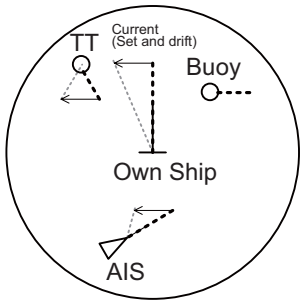
Speed selection	True vector mode
LOG(WT)	True-S
LOG(WTC)	True-G
LOG(BT)	True-G
GPS(BT)	True-G
REF(BT)	True-G
MAN(WT)	True-S
MAN(WTC)	True-G

Relative vector

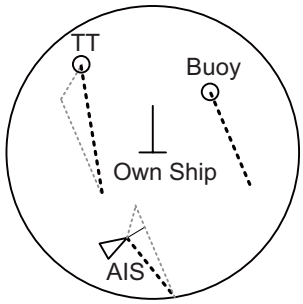
Relative vectors on targets that are not moving over the ground such as land, navigational marks and ships at anchor will represent the reciprocal of own ship's ground track. A target whose vector passes through own ship is on a collision course. (Dotted lines in the figure are for explanation only.)



True vectors in ground stabilization



True vectors in sea stabilization



Relative vectors

3.9.2 Vector motion and length

Vectors may be displayed in true or relative motion. Vector time (or the length of vectors) can be set between 30 seconds and 60 minutes.

The vector tip shows an estimated position of the target after the selected vector time elapses. It can be valuable to extend the vector length to evaluate the risk of collision with any target.

From the Control Unit

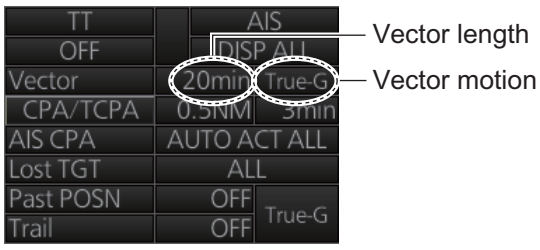
Vector motion: Push the **VECTOR MODE** key consecutively to select relative or true vector mode. Your selection is shown in the Vector mode indication.

Vector length: Push the **VECTOR TIME** key consecutively to select vector time, among. 30 seconds, 1 minute, 3 minutes, 5 minutes, 6 minutes, 10 minutes, 20 minutes, 30 minutes, 45 minutes and 60 minutes.

By trackball module

Vector motion: Click the vector motion indication at the right side of the screen to select relative or true vector mode.

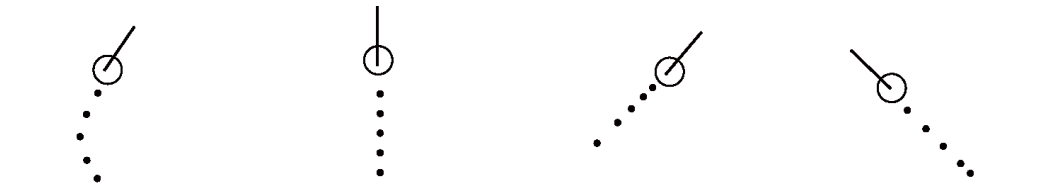
Vector length: Click the vector time indication at the right side of the screen to select time among 30 seconds, 1 minute, 3 minutes, 5 minutes, 6 minutes, 10 minutes, 20 minutes, 30 minutes, 45 minutes and 60 minutes. Or, spin the scrollwheel to select the length in one-minute intervals, from 1 - 60 minutes.



3.10 Past Position Display

The past position display shows equally time-spaced dots marking the past positions of any targets being tracked.

If a target changes its speed, the spacing will be uneven. If it changes the course, its plotted course will not be a straight line. See the illustration below for dot pattern and ship status.



(a) Ship turning

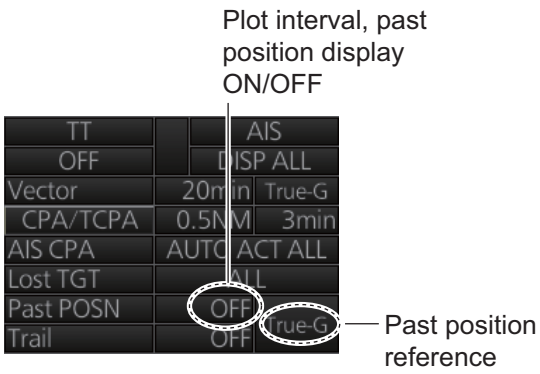
(b) Ship running straight

(b) Ship reduced speed

(b) Ship increased speed

3.10.1 How to enable/disable the past position display, select past position reference

Click the indications circled in the figure below to set the plot interval (or disable the display) and the past position reference (true or relative).



3.10.2 Past position points

You can show 5 or 10 past position points per tracked target. Right-click the past position indication then select [Past POSN Menu] to show that menu. Set [5 TT PAST POSN POINTS] to [5] or [10].

3.11 How to Enter Set and Drift

Set, the direction in which a water current flows, can be manually entered in 0.1-degree steps. Drift, the speed of the tide, can also be entered manually in 0.1 knot steps.

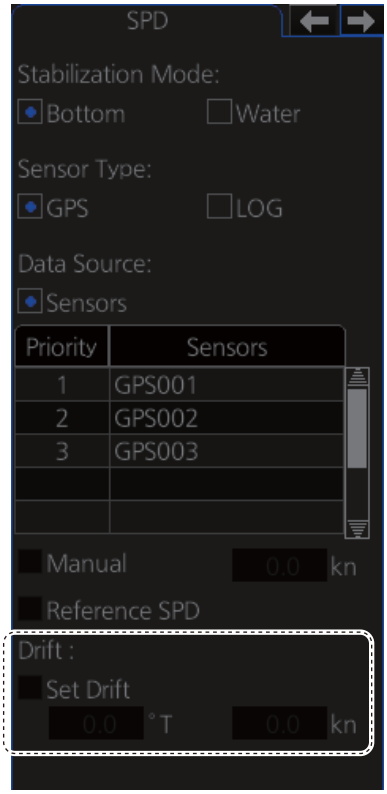
When course through water and speed through water are available, activate set and drift to get course over ground and speed over ground.

Set and drift corrections are beneficial for increasing the accuracy of vectors and target data. Refer to the tide table on board the ship for setting information. These values are applied to all targets. If stationary targets have vectors, set and drift values should be adjusted until they lose vectors.

Note: For the IMO type, turn off the AIS function in order to enter set and drift.

To enter set and drift do the following:

1. Right-click the speed indication then select [OS Info Menu] to show the [Own Ship Info] menu.
2. Select [2 SYSTEM SETTING] or [3 LOCAL SETTING] as appropriate.
3. Use the right and left arrow buttons to select the [SPD] page.



4. Set [Stabilization Mode] to [Water].
5. Click the [Set Drift] box to show a checkmark in the box.
6. Put the cursor in the course input box to show the up and down arrows. Click the arrows to enter the set.
7. Spur the cursor in the drift input box to show the up and down arrows. Click the arrows to enter the drift
8. Close the menu.

Note: Set and drift should be checked periodically for correctness.

3.12 TT CPA/TCPA Alarm

The TT continuously monitors the predicted range at the Closest Point of Approach (CPA) and predicted time to CPA (TCPA) of each TT. When the predicted CPA of any TT becomes smaller than the preset CPA range and its predicted TCPA less than the preset TCPA limit, the audio alarm sounds and the Alert 526 "CPA/TCPA" appears in the [Alert] box. In addition, the symbol of the offending TT is red and flashes together with its vector.

This feature, when used correctly, helps prevent the risk of collision by alerting you to threatening targets. It is important that the gain, sea clutter and rain clutter and other radar controls are properly adjusted.

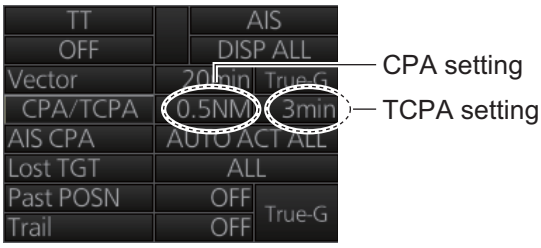
CPA and TCPA settings must be set up properly taking into consideration the size, tonnage, speed, turning performance and other characteristics of own ship.

The TT CPA/TCPA alarm should not be solely relied upon to warn you of collision situations. The operator should check all aids to navigation to monitor possible collision situations.

3.12.1 How to set the CPA and TCPA limits

To set the CPA and TCPA ranges, do the following:

1. If the values for CPA and TCPA are blank, click [CPA/TCPA] to show them.
2. Click the CPA indication to select desired CPA range (0.1-20 NM).
3. Click the TCPA indication to select desired TCPA time (1-60 minutes.).



3.12.2 How to enable, disable the TT CPA/TCPA alarm

The TT CPA/TCPA alarm can be enabled or disabled from the TT/AIS box. Click the indication shown below to enable or disable the TT CPA/TCPA alarm. The alarm is disabled when the CPA and TCPA settings are not shown.

3.12.3 How to acknowledge the TT CPA/TCPA alarm

When the CPA or TCPA of a target is within the CPA and TCPA limits, the Alert 526 "CPA/TCPA" appears in the [Alert] box and the audio alarm sounds. To acknowledge the alarm and silence the buzzer, push the **ALARM ACK** key on the Control Unit, or click the alert indication in the [Alert] box.

The alert in the [Alert] box and the flashing of the plotting symbol and vector continue until the dangerous situation is gone or you intentionally terminate tracking of the target.

3.13 TT Lost Target Alarm

Tracked targets not detected in five consecutive scans become "lost targets." When this occurs;

- A red X is put on the TT symbol (flashing) of the lost target. (The flashing stops after the lost target alarm is acknowledged.)
- The audio alarm sounds and the Alert 527 "Lost Target Alarm" appears in the [Alert] box.

3.13.1 How to enable, disable the TT lost target alarm

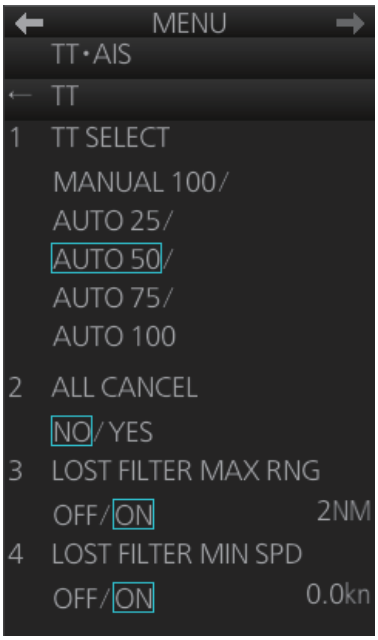
The [Lost TGT] indication at the bottom-right position enables, disables the lost target alarm. Click the indication to select [OFF], [ALL] or [FILT] as appropriate.

ALL: Get the alarm against all lost targets.
OFF: Disable the alarm.
FILT: Get the alarm against the targets whose criteria meet the settings made in section 3.13.2.

Note: The [Lost TGT] setting is shared commonly between TT and AIS.

3.13.2 How to set the TT lost target filter

If you are in an area where tracked targets are lost frequently, you may want to disable the lost target alarm against certain tracked targets, by maximum range or minimum speed.



1. Right-click the TT mode indication then select [TT Menu] to show that menu.
2. Select [3 LOST FILTER MAX RNG].
3. Spin the scrollwheel to select [ON]. Select the range setting then spin the scrollwheel to set the range. Any TT lost targets beyond this range will not trigger the TT lost target alarm.
4. Select [4 LOST FILTER MIN SPD].
5. Spin the scrollwheel to select [ON]. Select the speed setting then spin the scrollwheel to set the speed. Any TT lost targets slower than this setting will not trigger the TT lost target alarm.
6. Close the menu.

3.14 Trial Maneuver

The trial maneuver feature simulates the effect of own ship's movement against all tracked targets, without interrupting the updating of target information. It is available for use with the TT and AIS functions. For more accurate results, use relative motion and sea stabilization (water tracking).

3.14.1 Types of trial maneuvers

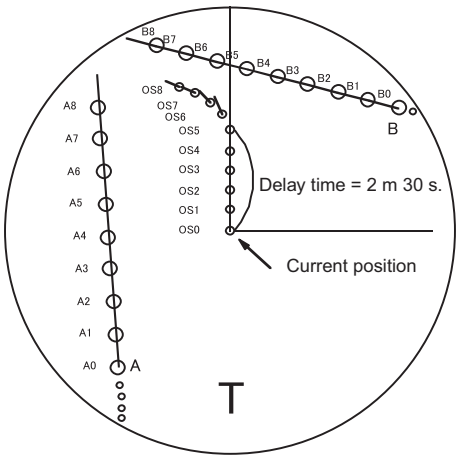
There are two types of trial maneuvers: static and dynamic.

Dynamic trial maneuver

A dynamic trial maneuver displays predicted positions of the tracked targets and own ship. You enter own ship's intended speed and course with a certain "delay time." Assuming that all tracked targets maintain their present speeds and courses, the targets' and own ship's future movements are simulated in one-second increments indicating their predicted positions in 30-second intervals as illustrated below.

The delay time represents the time lag from the present time to the time when own ship will actually start to change her speed and/or course. You should therefore take into consideration own ship's maneuvering characteristics such as rudder delay, turning delay and acceleration delay. This is particularly important on large vessels. How much the delay is set the situation starts immediately and ends in a minute.

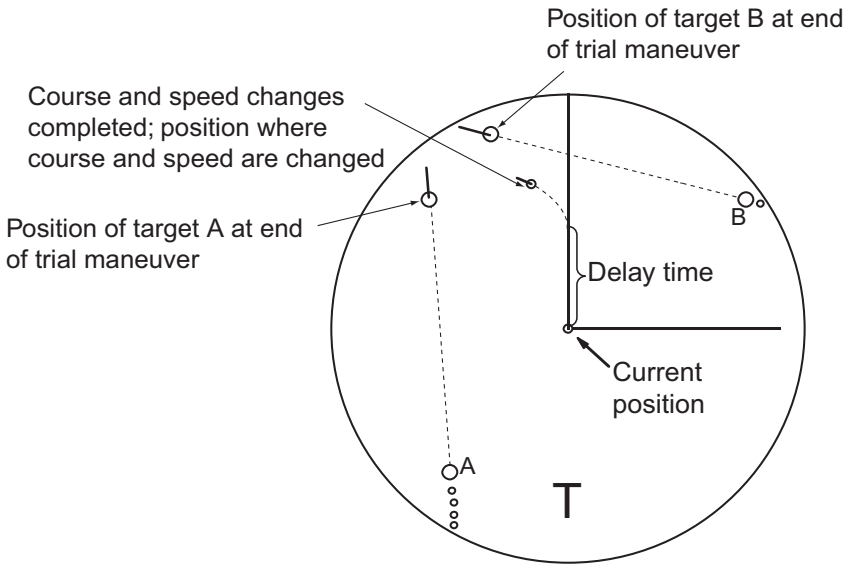
In the example shown below, own ship will advance straight ahead (even after a maneuver) for a delay time of 2:30 and alters speed and course until operator-specified intended speed and course are achieved (position OS7 in this example).



Static trial maneuver

The static trial maneuver shows the relationship between your ship and tracked targets at the completion of the trial maneuver. Enter expected course and speed and delay time until start of a maneuver and the expected position of your ship and TTs at the end of the trial maneuver are shown on the display.

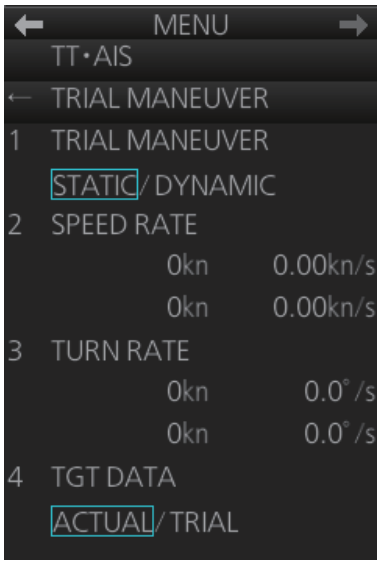
By shortening and extending the trial time you can find the safe time to make a maneuver. Thus, the static trial maneuver will be convenient when you wish to know the maneuver result immediately.



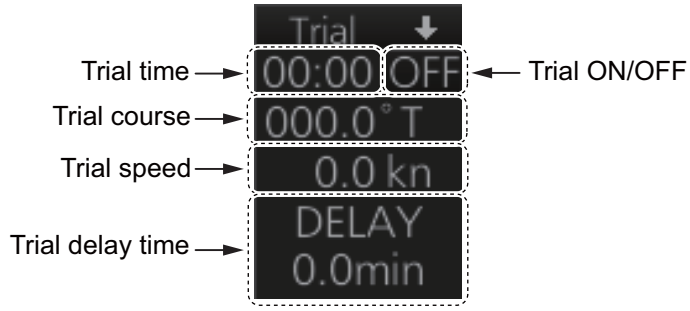
3.14.2 How to do a trial maneuver

To do a trial maneuver:

1. Right click the DELAY setting in the [Trial] box then select [Trial Maneuver Menu].
2. Select [1 TRIAL MANEUVER] then choose [STATIC] or [DYNAMIC] as appropriate.
3. Select [2 SPEED RATE] then set the speed rate with the scrollwheel.
4. Select [3 TURN RATE] then set the turn rate with the scrollwheel.
   Note: Two sets of trial speed and trial turn rate combinations are provided. This is done to provide accurate trial maneuver results for various ship's speeds and turn rates.
5. **For the B-type radar**, select [4 TGT DATA] then select whether to use [ACTUAL] or [TRIAL] data. (Skip this step if your radar is the IMO or A type.)
6. Click the [Close] button to close the menu.



7. Find the [Trial] box at the right side of the screen.



8. Right-click the Trial title bar, select [Trial Mode] then choose a trial mode, [Static] or [Dynamic].
9. Click the Trial ON/OFF indication to show [ON].
10. Click the Trial course indication. Spin the scrollwheel to set the trial course.
11. Click the Trial speed indication. spin the scrollwheel or use the Control Unit to set the trial speed.
12. Click the [DELAY] indication. Spin the scrollwheel to set the amount of delay. This is the time after which own ship takes a new situation, not the time the simulation begins. Change the delay time according to own ship loading condition, etc. Spin the scrollwheel to select numeric; push the left button to set.

The time indication depends on trial mode:
Dynamic mode: The position of your ship and TTs is updated and displayed every 30 seconds.
Static mode: The position of your ship and TTs when set course and speed are reached are displayed. The progress time until the position is reached is indicated on the display. The trial time can be changed from the Trial time indication. Put the cursor in the Trial time indication and roll the scrollwheel. The position of targets at the end of selected time is shown. Increase or decrease the time to get a safe maneuver. When the cursor is removed from the box the original positions of your ship and TTs are restored. If a maneuver is unsafe, change speed, course and delay until it is safe.

The trial maneuver takes place with the letter "T" displayed at the bottom of the screen. The time appears at the top-right position on the display. If any TT is predicted to be on a collision course with own ship (that is, the target ship comes within preset CPA/TCPA limits), the target plotting symbol flashes. If this happens, change own ship's trial speed, course or delay time to obtain a safe maneuver.

Terminating a trial maneuver

The termination depends on the trial mode as follows:
Dynamic mode: The trial is terminated when 60 minutes is shown in the Trial time indication.
Static mode: The trial is terminated when you terminate the trial maneuver manually.

To terminate the trial maneuver manually, click the Trial ON/OFF indication to show [Off].

3.15 TT Performance Test

A test program is provided for assessing overall performance of the TT. Normal operation is suspended and the indication "S" appears at the bottom of the effective display area during the test. The test may be terminated at any time.

1. Open the menu then select [8 INITIAL SETTING] and [8 TT TEST].
2. A window asks if you are ready to start the TT test. Click the [OK] button to start the test.

"S" flickers during the test. It takes approximately three minutes for all vectors to be displayed. The test does not need echo signals, gyro nor speed log input. Three targets having different speeds and courses, as shown in the table below, are simulated automatically, together with current targets. These targets can be treated as you would an ordinary TT - you can cancel them, display their data, etc.

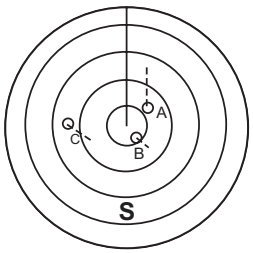
The test continues for ten minutes and repeats.

To terminate the test, push the **STBY TX** key on the Control Unit or click the [STBY/TX] button on the Status bar.

Select any simulated target with the cursor and check that the selected target shows the course and speed as in the table. CPA and TCPA shown in the table are with ship's speed of 0 kn. These values change with time and own ship's movement.

	Range	Bearing	Speed	Course	CPA	TCPA
Target A	3.0	45.0	20.0	0.0	2.0	-6.4
Target B	2.0	120.0	5.0	120.0	0.0	-24.0
Target C	7.0	270.0	100.0	120.0	3.5	3.5

The bearing and course values are when the heading is 0°.



3.16 TT Alerts

There are nine situations that cause the TT to trigger visual and audio alerts. To acknowledge the audio alerts, push the **ALARM ACK** key, or click the [Alert] box.

Alert No.	Message	Category	Description
520	TT System Error	Warning	TT system is inoperative. Checking heading sensor, antenna.
521	TT New Target	Warning	Tracked target entered the acquisition zone.
522	TT Auto ACQ 95%	Caution	The capacity for auto acquisition has reached 95%.
523	TT Auto ACQ 100%	Warning	The capacity for auto acquisition has reached 100% and no more target acquisition is possible. Cancel tracking on unnecessary targets.
524	TT Man ACQ 95%	Caution	The capacity for manual acquisition has reached 95%.
525	TT Man ACQ 100%	Warning	The capacity for manual acquisition has reached 100% and no more target acquisition is possible. Cancel tracking on unnecessary targets.
526	TT CPA/TCPA	Alarm	Tracked target on collision course. Take evasive action.
527	TT Lost	Warning	Tracked target lost. Check target.
528	REF Target Lost	Warning	Tracked target used for speed input is lost. To continue using reference target for speed input, select another tracked target.

3.17 Criteria for Selecting Targets for Tracking

The FURUNO TT video processor detects targets in midst of noise and discriminates radar echoes on the basis of their size. Target whose echo measurements are greater than those of the largest ship in range or tangential extent are usually land and are displayed only as normal radar video. All smaller ship-sized echoes that are less than this dimension are further analyzed and regarded as ships and displayed as small circles superimposed over the video echo.

When a target is first displayed, it is shown as having zero true speed but develops a course vector as more information is collected. In accordance with the IMO requirements for TT, an indication of the motion trend should be available within 20 scans of antenna and full vector accuracy within 60 scans. The FURUNO TT complies with these requirements.

Echo detection (quantization)

The entire picture is converted to a digital from called "Quantized Video." A sweep range is divided into small segments and each range element is "1" if there is radar echo return above a threshold level, or "0" if there is no return.

The digital radar signal is then analyzed by a ship-sized echo discriminator. As the antenna scans, if there are five consecutive radar pulses with 1's indicating an echo presence at the exact same range, a target "start" is initiated. Since receiver noise is random, it is not three-bang correlated, and it is filtered out and not classified as an echo.

The same is true of radar interference. Electronic circuits track both the closest and most distant edges of the echo. At the end of the scanning of the echo, the discriminator indicates the measured maximum range extent and total angular extent subtended by the echo. If the echo is larger than a ship-sized echo in range extent and/or angular width, adjusted as a function of range, it is declared to be a land. This land echo is not used by TT acquisition and tracking process. All smaller echoes are declared to be ship sized and the middle of the leading edge is used to provide precise range and bearing coordinates of each echo on every scan. This range/bearing data is matched to previous data and analyzed from scan-to-scan for consistency. When it is determined to be as consistent as a real target, automatic acquisition occurs and tracking is initiated. Continued tracking and subsequent calculation develop the relative course and speed of the target.

Acquisition

A target that is hit by five consecutive radar pulses is judged to be a radar echo. Manual acquisition is done by designating a detected echo with the trackball. Automatic acquisition is done in the acquisition areas when a target is detected 5-7 times continuously depending upon the congestion.

Tracking

The range and bearing of an echo are found from the relative distance of the target from the radar antenna. The distance a tracked target moves between radar antenna rotations is used to calculate the relative speed of the tracked target. However, because of calculation error, smoothing is applied to get stable target speed and course data. When a target changes course, smoothing is reduced in order to quickly follow target movement.

Tracking is achieved when the target is clearly distinguishable on the display for 5 out of 10 consecutive scans, whether acquired automatically or manually.

Required tracking facilities are available within 0.1-32 nm on range scales including 3, 6, 12 nm, full plotting information is available within one scan when the range scale is changed. Targets not detected in nine consecutive scans become "lost targets."

The true course and speed of own ship are computed from own ship's gyro and speed inputs, and the resulting course and speed of each tracked target is easily computed by vector summing of the relative motion with own ship's course and speed. The resulting true or relative vector is displayed for each of the TTs. This process is updated continually for each target on every scan of the radar.

The REF point for tracked target calculation can be the radar antenna position or the CCRP. For CCRP, the displayed value includes the distance between the CCRP and the antenna position. Therefore, when switching the REF point, the range, bearing, CPA and TCPA of the tracked targets change.

Qualitative description of tracking error

The FURUNO TT's accuracy complies with or exceeds IMO standards.

Own ship maneuvers

For slow turns there is no effect. For very high turning rates (greater than 150°/minute, depending on gyro), then all tracked targets revert to full accuracy.

Other ship maneuvers

Target ship courses; lag 15 to 30 seconds at high relative speed, or 3 to 6 seconds at low (near 0) relative speed. It is less accurate during a turn due to lag, but accuracy recovers quickly.

3.18 Factors Affecting Target Tracking

Sea returns

If the radar anti-clutter control is adjusted properly, there is no serious effect because distant wave clutter, not eliminated by this control, is filtered out by more than one bang correlation and scan-to-scan matching of data.

Rain and snow

Rain clutter can be acquired and tracked as targets. Adjust the rain clutter control to suppress the clutter. If it is heavy rain, switch to S-band if provided, or switch on the interference rejector on the radar. If heavy clutter still exists, switch to manual acquisition. Accuracy can be affected.

Low clouds

Usually no affect. If necessary, adjust the rain clutter control.

Non-synchronous emissions

No effect.

Low gain

Insufficient or low radar receiver gain will result in some targets not being acquired at long distance. The TT display will be missing on one or more targets that could only be visible if the radar sensitivity control (**GAIN** control) were increased.

The setting of the correct radar receiver gain is not critical but the target should be on the radar PPI and be clearly visible and well defined.

Manual acquisition is done if a target is positively displayed more than once. Automatic acquisition is done when the target is detected 5-7 times continuously.

Tracking continues if a return echo is received at least once in nine antenna rotations. However, the fewer the return echoes the lower the accuracy. If no return echo is received within nine antenna rotations the target is declared a lost target.

Second trace echoes

When the radar beam is super refracted, strong echoes may be received at such long ranges that they appear on a different timebase sweep than the transmitted pulse. This gives an incorrect range indication. Second- and third-trace echoes can be tracked if they are consistent enough to meet acquisition and tracking criteria but target course and speed data will be in error.

Blind and shadow sectors

Radar shadow or blind areas caused by obstructions aboard the ship, for example, funnels and masts, in the path of the radar beam can result in reduction of radar beam intensity in that particular direction. This may eliminate the detection of some targets. The TT system will lose track of targets shortly after they are lost on the radar picture and if they remain in a blind zone. These targets will however be acquired and tracked when they pass out of the blind zone and again present normal radar echo. The angular width and bearing of any shadow sector should be determined for their influence on the radar. In certain cases false echoes in the shadow sector cause the TT system to acquire, track, and vector them. Shadow sectors should be avoided.

Indirect echoes

A target at close range is usually picked up directly, but it can also be received as reflection from a large, flat surface. This will result in the radar presenting two or more echoes on the display, each at a different range. The TT system can acquire and track a false echo if it is detected in five consecutive scans. Reduction in radar gain can eliminate the multiple echoing but care should be taken as range detection also will be reduced.

Radar interference

If interference is extreme due to another radar operating at close range, spiral "dotting" and/or false targets may appear momentarily. The interference rejector can clear the display.

Delay of sensor input

If the refresh rate of the gyrocompass signal is too slow, error in target bearing occurs when own ship turns. To prevent this error, the refresh rate of the gyrocompass signal must be as indicated in the System Configuration drawings.

4. AIS OPERATION

An AIS transponder can be connected to this radar to overlay AIS targets on the radar display. The radar can store up to 2,000 AIS targets in its storage buffer. When this buffer becomes full of AIS targets, the Alert 533 "AIS Target Capacity 100%" is generated to alert you to full storage buffer. The storage buffer contains automatic dead reckoning for all AIS targets, which is based on reported Speed Over the Ground (SOG), Course Over the Ground (COG), Rate Of Turn (ROT) and heading. The storage buffer also contains calculation of range, bearing, CPA, TCPA, etc. The CPA and TCPA limits set for dangerous targets are common for TT and AIS targets.

This radar can activate 500 AIS targets. The Alert 535 “AIS Target Activate 100%” is generated when 500 AIS targets are activated.

This radar can display a maximum of 1,000 AIS targets. The Alert 531 “AIS Target Display 100%” is generated when 1,000 AIS targets, which includes both activated and sleeping targets, are displayed.

The frequency for update of AIS transponder-sent data depends on speed and course of tracked AIS target. The table below shows the IMO standardized reporting rates for the AIS transponder. Based on the table below, the radar defines which AIS targets are in tracking or lost. When you acknowledge a lost target alert, the corresponding AIS symbol will be removed from the display.

Type of Ship	IMO nominal reporting interval	Lost target indication (reporting interval >)
Class A: Navigation status is “anchor” or “not under command” or “moored” or “aground”, and SOG < 3kn	3 min	10 min
Class A: Navigation status is “anchor” or “not under command” or “moored” or “aground”, and SOG ≧ 3kn	10 s	50 s
Class A: 0kn ≦ SOG < 14kn	10 s	50 s
Class A: 14kn ≦ SOG ≦ 23kn	6 s	30 s
Class A: SOG > 23kn	2 s	10 s
Class B: “CS” SOG ≦ 2kn	3 min	10 min
Class B: “CS” SOG > 2kn	30 s	150 s
Class B: “SO” 0 kn ≤ SOG < 2kn	3 min	10 min
Class B: “SO” 2 kn ≤ SOG < 14kn	30 s	150 s
Class B: “SO” 14 kn ≤ SOG ≦ 23kn	15 s	150 s
Class B: “SO” 14kn ≦ SOG < 23kn	5 s	150 s
Class A and Class B: no SOG available	N/A	10 min
AIS SAR aircraft	10 s	50 s
AIS aid to navigation	3 min	10 min
AIS base station	10 s	50 s
AIS search and rescue transponder	N/A	10 min

An AIS transponder "sees" all ships fitted with an AIS transponder belonging to either a Class A or Class B AIS. Additionally, the AIS transponder receives messages from ships and non-ships (AIS SAR aircraft, AIS aid to navigation, AIS base station, and AIS search and rescue transmitter).

There can be several hundreds or several thousands of AIS targets, and of those only a few will be significant for your ship. To remove unnecessary AIS targets from the radar display, the feature "active and sleeping AIS targets" is available. Initially any new AIS target received by an AIS transponder is not active (="sleeping"). Such sleeping targets are shown with a small triangle. The operator can pick any AIS target and change it from sleeping to active. Active AIS targets are shown with a large triangle with speed vector, headline, ROT indicator, etc. Further, the operator can pick active AIS targets and change their status to sleeping.

An indication of AIS target activated capacity limit is given well before it is reached. When 95% of 500 targets are activated, the Alert 534 "AIS Target Activate 95%" appears. When 500 targets are activated, the Alert 535 "AIS Target Activate 100%" appears.

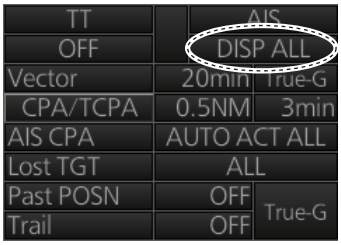
An indication of AIS target display capacity limit is given well before it is reached. When 95% of 1,000 targets are displayed, the Alert 530 "AIS Target Display 95%" appears. When 1,000 targets are displayed, the Alert 531 "AIS Target Display 100%" appears.

An indication of AIS target processing capacity limit is given well before it is reached. The Alert 532 "AIS Target Capacity 95%" will be given when 95% of 2,000 targets are in the storage buffer and the Alert 533 "AIS Target Capacity 100%" appears when 2,000 targets are in the storage buffer.

This radar generates AIS-related alerts. These are Alert 536 "AIS CPA/TCPA" and Alert 537 "AIS Lost". Only active AIS targets generate alerts. The operator can activate or sleep AIS target alerts as desired. The feature "active and sleeping AIS targets" is very effective for focusing on only those AIS targets that need supervision. This radar further eases the task of the operator by automatically changing non-active targets to active targets, if their CPA and TCPA are within a preset limit.

4.1 How to Deactivate the AIS Function

Long-click the AIS status indication at the bottom-right position to display [FUNC OFF] to deactivate the AIS function (sleep all AIS targets) and AIS messaging facility. To activate AIS, push the left button again.



Note: You cannot enable AIS if any of the items listed below are active.

- Manual speed
- Manual set & drift
- Speed is calculated from reference targets

4.2 How to Show, Hide the AIS Display

Targets that are being tracked by an AIS transponder can also be displayed on the display. Click the AIS status indication to select [DISP OFF], [DISP FILT] or [DISP ALL].

DISP OFF: Turn off the AIS display. (Tracking continues internally.)
DISP FILT: Filter AIS targets according to the settings of the AIS target filter. See section 4.4.
DISP ALL: Display all AIS targets.

4.3 AIS Symbols

Symbol	Default Color	Name	Description
	Green	AIS tracked target past position point	Mark past position.
	Green	Sleeping AIS target	Denote sleeping AIS symbol. (Lines are thinner than Active AIS symbol.)
	Green	Activated AIS target	Denote active AIS target, with vector (Lines are thicker than sleeping AIS symbol.)
	Green	Activated target in AZ	Active AIS target in acquisition zone, with vector. (Lines are thicker than Active AIS symbol.)
	Green	Activated target, true scale symbol	Active AIS target with symbol shown in true scale).
	Red (fixed)	Dangerous AIS target	Target's CPA and TCPA are within the CPA and TCPA settings. Vector shown.
	Green	Association AIS target	AIS and TT target declared as "association target." AIS symbol and AIS data are used.
	Red (fixed)	Association AIS dangerous target	AIS and TT target declared as "association target." AIS symbol and AIS data are used. Target's CPA and TCPA are within limits set.
	Green	Heading-turn indicator	Show target's direction of turning.
	Green	AIS ATON	AIS Aid to navigation
	Green	Virtual AIS ATON	Virtual AIS aid to navigation
	Green	SAR Aircraft	
	Green	AIS base station	
	Green	AIS select symbol	Target selected to display its data.
	Red (fixed)	AIS lost symbol	X is superimposed on the AIS target symbol and is flashing.

Note 1: The equipment continues to process AIS targets when the AIS feature is switched off. When the AIS is again turned on, symbols are immediately displayed.

Note 2: AIS symbols are momentarily erased after the screen is redrawn when the heading is changed from the head-up mode.

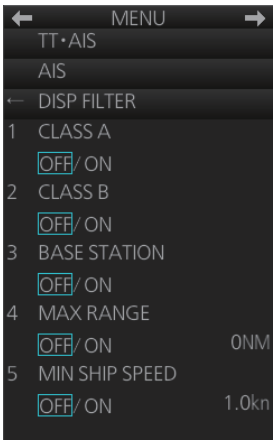
Note 3: When no AIS data is received, the Alert 380 "AIS Receive Error" appears in the [Alert] box. Check the AIS transponder.

Note 4: An AIS target is declared a lost target if it is not detected in five consecutive reporting periods.

4.4 How to Filter AIS Targets

If the screen becomes cluttered with AIS targets, you can filter out unnecessary AIS targets, from the [DISP FILTER] menu.

1. Right-click the AIS mode indication then click [AIS Menu] to show that menu.
2. Open the [5 DISP FILTER] menu.



3. At [1] - [3], disable or enable tracking of respective item as appropriate.
4. Select [4 MAX RANGE] and set the maximum range to display an AIS target. An AIS target not within the range set here is not displayed.
5. Set the minimum ship speed for AIS targets, with [5 MIN SHIP SPEED]. Any AIS target whose speed is slower than that set here will not be displayed.
6. Close the menu.

4.5 How to Activate Targets

When you convert a sleeping target to an activated target, an activated target's course and speed are shown with a vector. You can easily judge target movement by monitoring the vector.

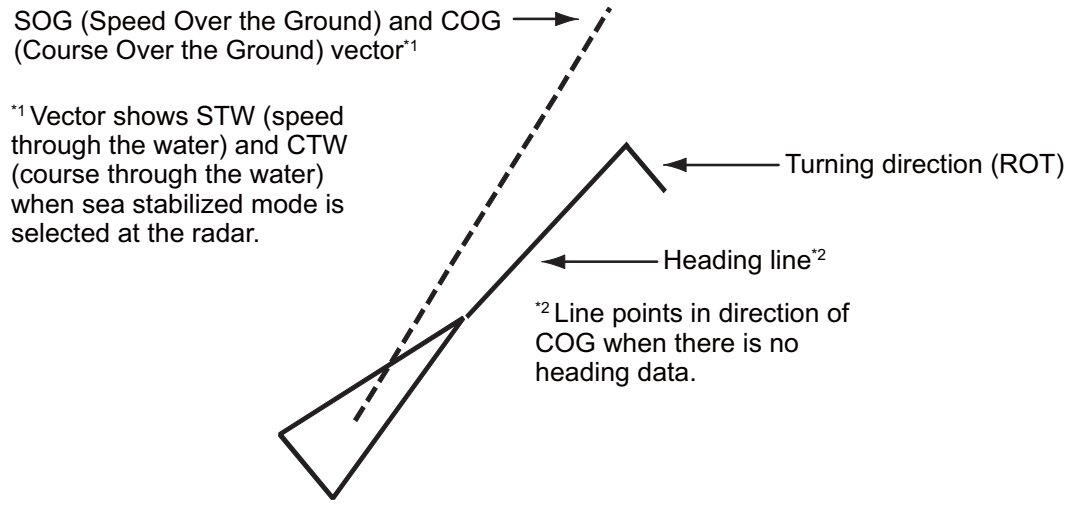
4.5.1 How to activate specific target

From the Control Unit

Select the target with the cursor then press the **ACQ/ACT** key.

By the trackball module

Click the AIS target symbol.

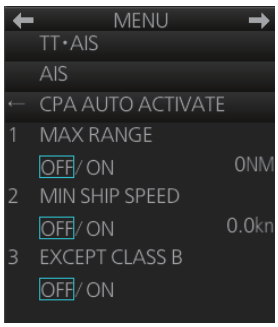


4.5.2 How to automatically activate targets

You can get automatic activation of a sleeping AIS target when its CPA/TCPA are within a preset limit. The CPA/TCPA alarm must be active to use this feature.

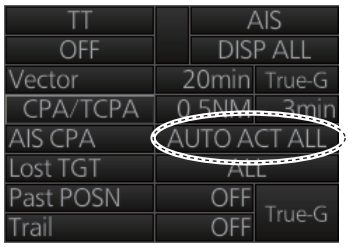
How to set conditions for automatic activation of AIS targets

1. Right-click the AIS mode indication then click [AIS Menu] to show that menu.
2. Open the [4 CPA AUTO ACTIVATE] menu.
3. Set items 1 - 3, referring to the description below.
   1 MAX RANGE: Set the maximum range to use. Any AIS target at a distance greater than set here will not be activated.
   2 MIN SHIP SPEED: Set the minimum speed to use. Any AIS target whose speed is slower than set here will not be activated.
   3 EXCEPT CLASS B: Select ON to exclude class B AIS targets.
4. Close the menu.



How to enable, disable automatic activation of AIS targets

Click the location circled in the figure below to select one of the following:
AUTO OFF: Disable automatic activation of AIS target by CPA.
AUTO ACT FILT: Activate AIS targets that fulfil the requirements set on the [CPA AUTO ACTIVATE] menu.
AUTO ACT ALL: Activate all AIS targets within the CPA range set.



4.6 How to Sleep Targets

4.6.1 How to sleep an activated AIS target

You can "sleep" an activated AIS target as shown below when the screen becomes filled with targets that might prevent important radar and AIS targets from being identified. The targets that have been activated automatically cannot be "slept."

From the Control Unit

Put the cursor on the AIS target to sleep then press the **TARGET CANCEL** key.

By the trackball module

RIght-click the AIS target symbol to show the context-sensitive menu. Select [Target Cancel] followed by [Any] or [AIS Only].

4.6.2 How to sleep all activated AIS targets

Sleep all activated targets from the menu

1. Right-click the screen the show the context-sensitive menu.
2. Select [Target Cancel] and [Any] or [AIS Only] as applicable.
3. Click the AIS target to sleep.

Sleep all activated targets from the AIS box

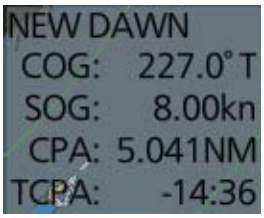
Long-click the AIS status indication at the bottom-right position to display [FUNC OFF] to deactivate the AIS function and sleep all AIS targets.

4.7 How to Display AIS Target Data

You can display an AIS target's data by selecting it on the display.

4.7.1 AIS pop-up information

The AIS pop-up shows abbreviated AIS data (COG, SOG, CPA and TCPA) for the selected AIS target. Simply put the cursor on the AIS target to show the pop-up. The pop-up can be enabled or disabled with [AIS POP-UP INFO] in the [TT/AIS SYMBOL] menu



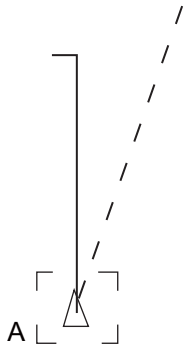
4.7.2 Basic AIS target data

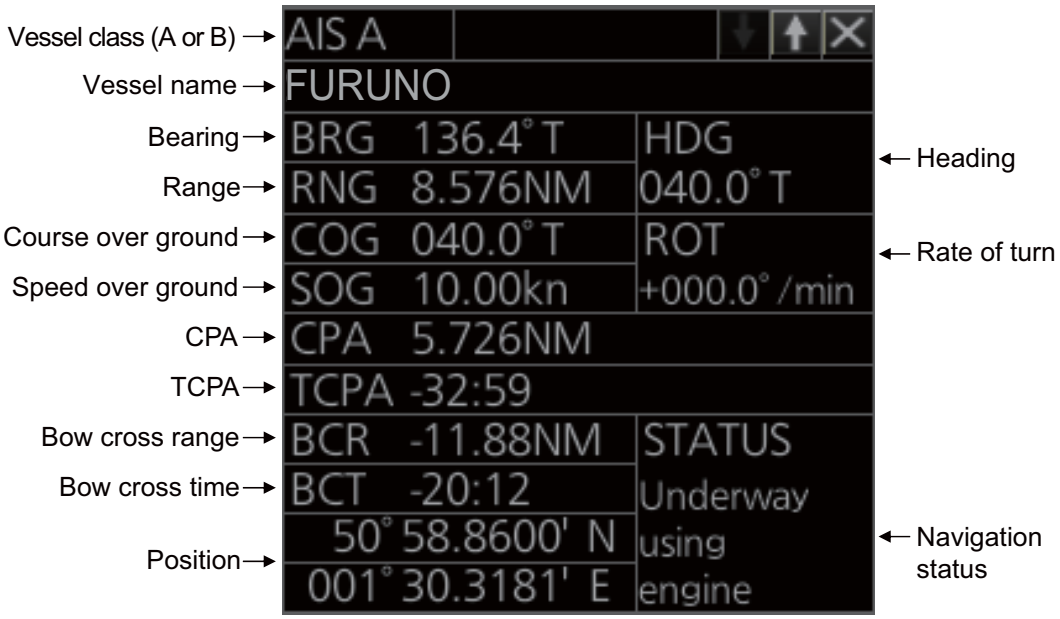
From the Control Unit

1) Use the trackball to put the cursor on the activated AIS target symbol you want to know its data.
2) Press the **TARGET DATA** key.
3) The selected target is marked with a broken square and AIS data is shown in the AIS data box when the target is correctly selected.

By a trackball module

Click the activated AIS target symbol. The selected target is marked with a broken square and AIS data is shown in the AIS data box when the target is correctly selected.





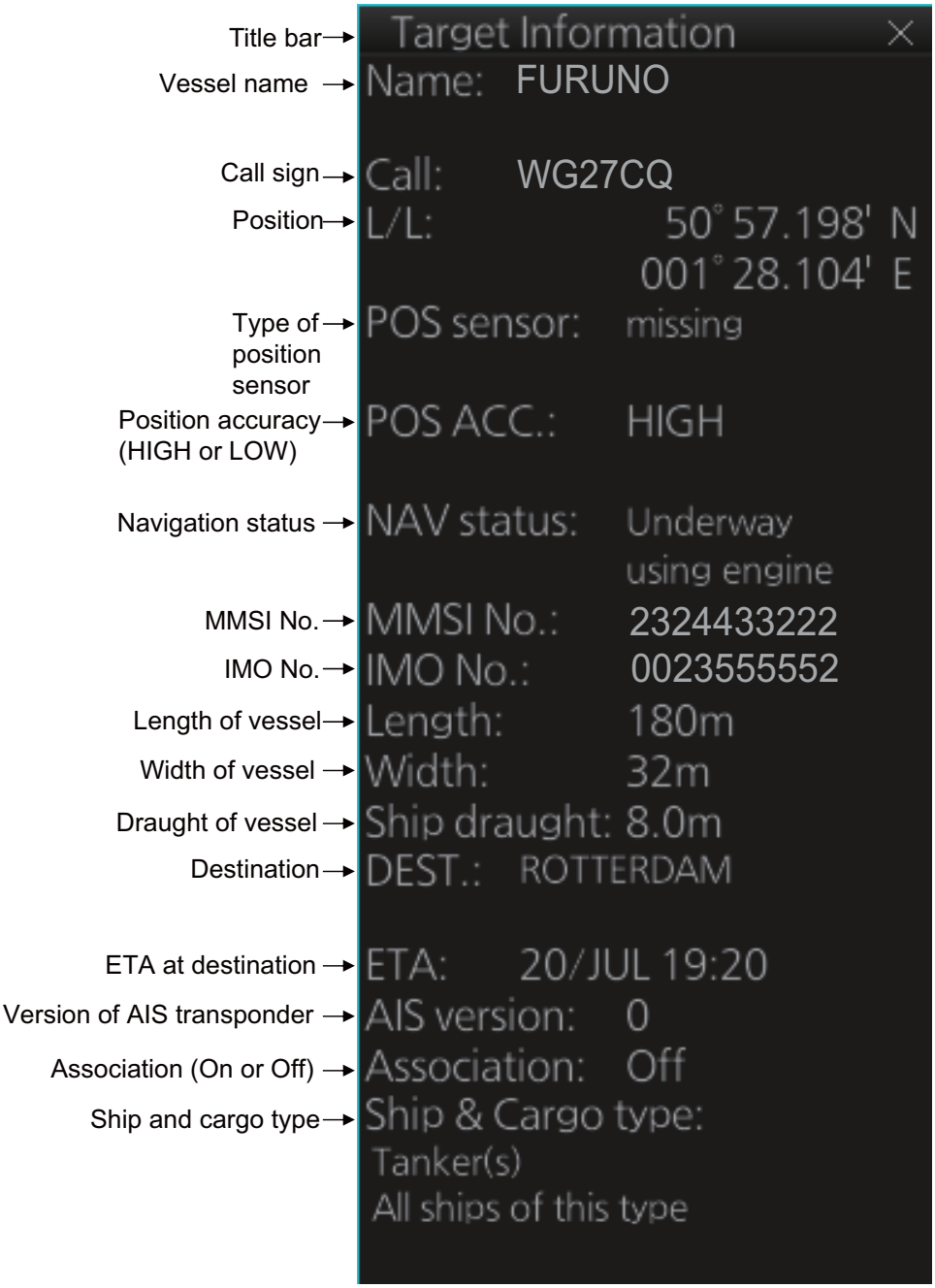
Note 1: AIS is switched off in dead reckoning.

Note 2: The indication "Query" appears when receiving only dynamic data: "Tracking" appears after receiving static data.

Note 3: If the TCPA value is negative, this means that you have already passed the closest point and the AIS target is going away from your ship.

4.7.3 Expanded AIS data

The expanded AIS data display provides additional information about an AIS target, including call sign, MMSI No., IMO No., etc. To display expanded AIS data, show the basic data for a target, right-click the target data display then select [AIS Expanded Data].



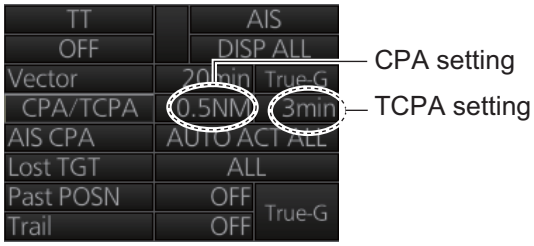
If data for an item is unknown, "missing" appears. In the example above, the name of the position sensor is “missing”.

4.8 AIS CPA/TCPA Alarm

This radar calculates CPA and TCPA by using own ship and relative target positions. An AIS dangerous target is one whose CPA and TCPA are within the range of the CPA and TCPA limits set in the TT/AIS box. The AIS symbol of an AIS dangerous target is red and flashing, and is announced with the Alert 536 "AIS CPA/TCPA". After the alert is acknowledged the target symbol is displayed in red color.

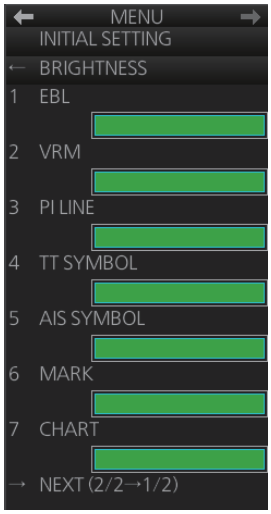
To set the CPA and TCPA ranges, do the following:

1. If the CPA and TCPA settings are not shown, click [CPA/TCPA].
2. Click the CPA indication to select desired CPA range.
3. Click the TCPA indication to select desired TCPA setting.



4.9 AIS Symbol Brilliance

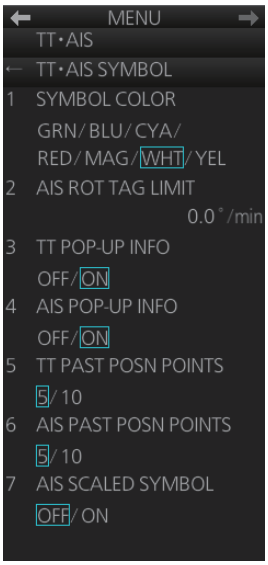
1. Right-click the [BRILL] button on the InstantAccess bar then select [BRILL menu].
2. Go to page 2, select [AIS SYMBOL] then spin the scrollwheel to adjust the brilliance.



3. Close the menu.

4.10 AIS Symbol Color

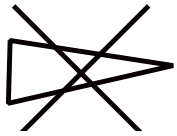
1. Right-click the AIS mode indication then click [Symbol Menu] to show that menu.



2. Select [1 SYMBOL COLOR] and desired color. (Red and yellow are not available with the IMO type.)

4.11 AIS Lost Targets

An AIS target is declared a lost target when it fails to produce data for intervals which are based on the table on page 4-1. When this occurs, the target is marked with the lost target symbol (flashing), shown in the right figure, the buzzer sounds (for activated targets only) and the Alert 537 "AIS Lost" appears.



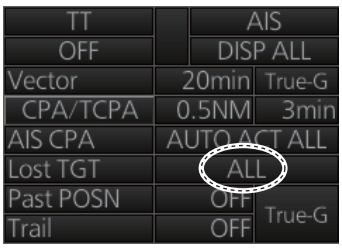
To acknowledge a lost target, push the **ALARM ACK** key or click the [Alert] box.

Note 1: If a TT lost target mark is displayed when the **ALARM ACK** key is pushed (or the [Alert] box is clicked) to acknowledge an AIS lost target, the TT lost target will also be erased.

Note 2: The AIS data transmission interval depends on target's speed. For example, the data is transmitted every 10 seconds on the ship speed of 0 to 14 kn and every two seconds on the ship speed of more than 23 knots. For details, see the owner's manual of the AIS transponder.

4.11.1 How to enable, disable the AIS lost target alarm

The Lost TGT indication (at the bottom-right position) enables, disables the lost target alarm. Click the indication to select [OFF], [ALL] or [FILT] as appropriate.

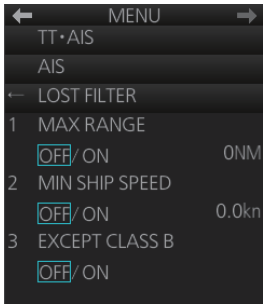


OFF: Disable the lost target alarm.
ALL: Get the alarm against all lost targets.
FILT: Get the alarm against the targets whose criteria meet the settings made in section 4.11.2.

Note: The [Lost TGT] setting is shared commonly between TT and AIS.

4.11.2 How to set the AIS lost target filter

If you are in an area where AIS targets often become lost, the lost target alarm may activate frequently. In this case, you may want to specify which targets to classify as lost targets, to prevent frequent triggering of the lost target alarm.

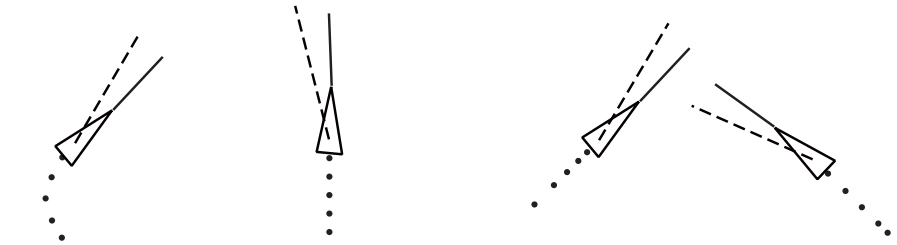


1. Right-click the AIS mode indication then click [AIS menu] to show that menu.
2. Open the [6 LOST FILTER] menu.
3. Set items 1-3, referring to the description below.
   1 MAX RANGE: Set the maximum range to use. Any AIS target at a distance greater than set here will not trigger the lost target alarm.
   2 MIN SHIP SPEED: Set the minimum speed to use. Any AIS target whose speed is slower than set here will not trigger the lost target alarm.
   3 EXCEPT CLASS B: Select ON to exclude class B AIS targets from the lost target alarm.
4. Close the menu.

4.12 How to Display AIS Target Past Positions

The past position display shows equally time-spaced dots marking past positions of activated AIS targets. If a target changes its speed, the spacing will be uneven. If it changes course, its plotted course will not be a straight line.

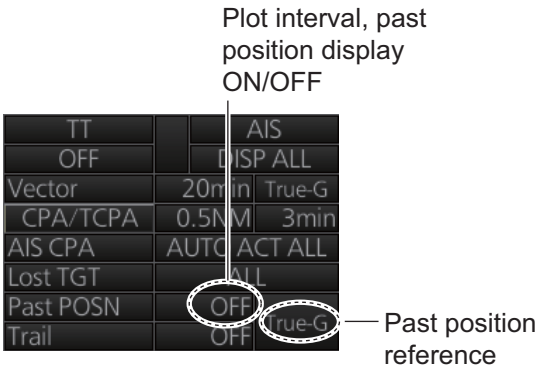
Below are sample past position displays.



(a) Ship turning (b) Ship running straight (c) Ship reduced speed (d) Ship increased speed

4.12.1 How to enable/disable the past position display, select past position reference

Click the indications circled in the figure below to set the plot interval (or disable the display) and the past position reference (true or relative).



4.12.2 Past position points

You can show 5 or 10 past position points per AIS target. Right-click the past position indication then click [Past POSN Menu] to show that menu. Set [6 AIS PAST POSN POINTS] to [5] or [10].

4.13 How to Display True or Relative Speed Vectors

AIS targets vector can be displayed relative to your ship's heading (relative) or with reference to the North (True).

Vector time (or the length of vectors) and presentation mode can be set at the bottom-right position on the screen. For further information, see section 3.9.

4.14 Association of TT and AIS Targets

An AIS-equipped ship is usually displayed by two symbols on the radar display. This is because the AIS ship position is measured by a GPS navigator (L/L) whereas the radar detects the same ship by PPI principle (range and bearing relative to own ship radar antenna).

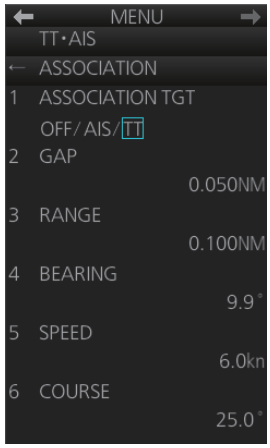
To avoid the presentation of two target symbols for the same physical target, use the "association" function. If target data from both AIS and TT are available and if the association criteria are fulfilled, either the AIS or TT symbol is presented according to the association method selected.

Association will not happen between AIS and TT if the AIS target is sleeping or the AIS target is lost.

4.14.1 How to select association method

Click the location circled below to show "<" to select AIS symbol for associated target, or ">" to select TT symbol for associated target. This setting overrides the corresponding item on the [TT/AIS Menu].

4.14.2 How to set the conditions for association



1. Open the menu then select the [TT/AIS] and [6 ASSOCIATION] menus.
2. Enter the association conditions, referring to the following:
   ASSOCIATION TGT: Disable Association with [OFF], or select [AIS] or [TT]. [AIS] selects the AIS symbol for association target; [TT] selects the TT symbol for the association target.
   GAP: Range between AIS target and TT.
   Setting range: 0.000-0.999(NM)
   RANGE: Enter the range difference from own ship to AIS target and TT.
   setting range: 0.000-0.999(NM)
   BEARING: Enter the bearing difference from own ship to AIS target and TT.
   Setting range: 0.0-99.9(°)
   SPEED: Enter the speed difference between AIS target and TT.
   Setting range: 0.0-9.9(kn)
   COURSE: Enter the course difference between AIS target and TT.
   Setting range: 0.0-99.9(°)

When the association criteria are met

- either the AIS or TT symbol is erased according to association made in section 4.14.1.
- the Alert 560 "Association" appears in the [Alert] box.

4.15 Voyage Data

Before you embark on a voyage, set your navigation status, ETA, destination, draught and crew, on the [VOYAGE DATA] menu.

1. Click the [OWN AIS] button on the InstantAccess bar to show the [VOYAGE DATA] menu.

2. Select [1 NAV STATUS] then use the scrollwheel to set the applicable two-digit nav status code, referring to the table below.

No.	Nav status	No.	Status
00	Underway using engine	08	Under way Sailing
01	At anchor	09	Reserved for high speed craft
02	Not under command	10	Reserved for wing in ground
03	Restricted Maneuverability	11	Reserved for future use
04	Constrained by her draft	12	Reserved for future use
05	Moored	13	Reserved for future use
06	Aground	14	AIS SART
07	Engaged in fishing	15	Not Defined

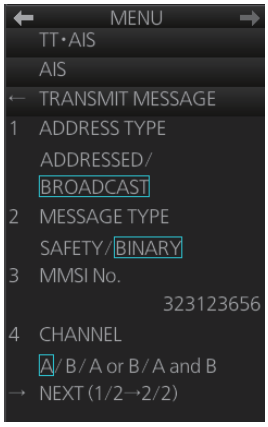
3. Select [2 ETA] then use the scrollwheel to enter ETA: day (two digits), month (two digits), year (four digits) and time (four digits).
4. Select [3 DESTINATION] then use the software keyboard to enter the name of your destination, using a maximum of 20 characters.
5. Select [4 DRAUGHT] then use the scrollwheel to enter ship's draft (0.0 - 25.5 (m)).
6. Select [5 CREW] then use the scrollwheel to enter the number of crew (0000-8191).
7. Close the menu.

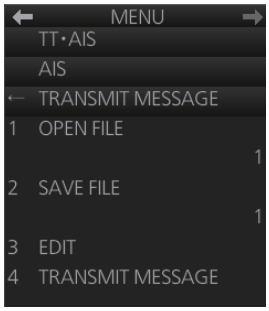
4.16 AIS Messages

You can send and receive messages via the VHF link, to a specified destination (MMSI) or all AIS-equipped ships within communication range of your ship. Messages can be sent to warn of safety of navigation, for example, an iceberg sighted. Routine messages are also permitted. Short safety-related messages are only an additional means to broadcast safety information. They do not remove the requirements of the GMDSS.

4.16.1 How to create and transmit a new AIS message

You can create and send an AIS message as follows:





1. Right-click the AIS mode indication then click [AIS Menu] to show that menu.
2. Open the [8 TRANSMIT MESSAGE] menu.
3. At [1 ADDRESS TYPE], select [ADDRESSED] to send the message to a specific AIS-equipped ship, or [BROADCAST] to send the message to all AIS-equipped ships within VHF communication range. For [ADDRESSED], enter MMSI of ship at [3 MMSI No.].
4. At [2 MESSAGE TYPE], select [SAFETY] for safety message, or [BINARY] for routine message.
5. At [4 CHANNEL], select the channel over which to broadcast your message. The choices are [A/B], [A or B] or [A and B].
6. Click [NEXT] to go to the next page.
7. Select [3 EDIT]. A text input box appears together with the software keyboard. Use the software keyboard to enter your message. The number of characters that may be entered depends on message type, and the number of characters available appears below the text box.
   Safety message broadcast: 161 characters
   Binary message broadcast: 156 characters
   Safety message addressed to MMSI: 156 characters
   Binary message addressed to MMSI: 151 characters
8. To save the file, select [2 SAVE FILE].
9. To transmit the message, click [4 TRANSMIT MESSAGE]. You are asked if you are sure to transmit the message. Click the [OK] button to transmit the message.

The Alert 542 "AIS Transmitting" appears in the [Alert] box while the message is being transmitted. If the message could not be transmitted, the Alert 541 "AIS Message Transmit Error" appears.

4.16.2 How to transmit a saved AIS message

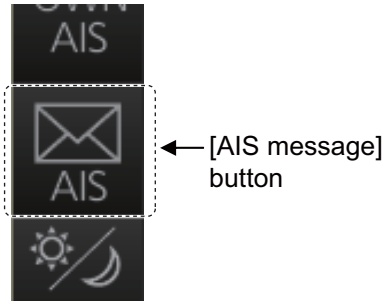
If you have saved some previously transmitted AIS messages, you can edit one and send it as follows.

1. Right-click the AIS mode indication then click [AIS Menu] to show that menu.
2. Open the [8 TRANSMIT MESSAGE] menu.
3. Go to page 2 of the menu, select [1 OPEN FILE] then select the number of the message to transmit.
4. Select [3 EDIT] to edit the message.
5. To save the message, select [2 SAVE FILE].
6. To transmit the message, select [4 TRANSMIT MESSAGE]. You are asked if you are sure to transmit the message. Click the [OK] button to transmit the message.

4.16.3 How to display received AIS messages

When you receive an AIS message, the Alert 539 "AIS Message Received" appears.

The message is displayed automatically or manually depending on a menu setting. To display the message manually, click the AIS message button on the InstantAccess bar.



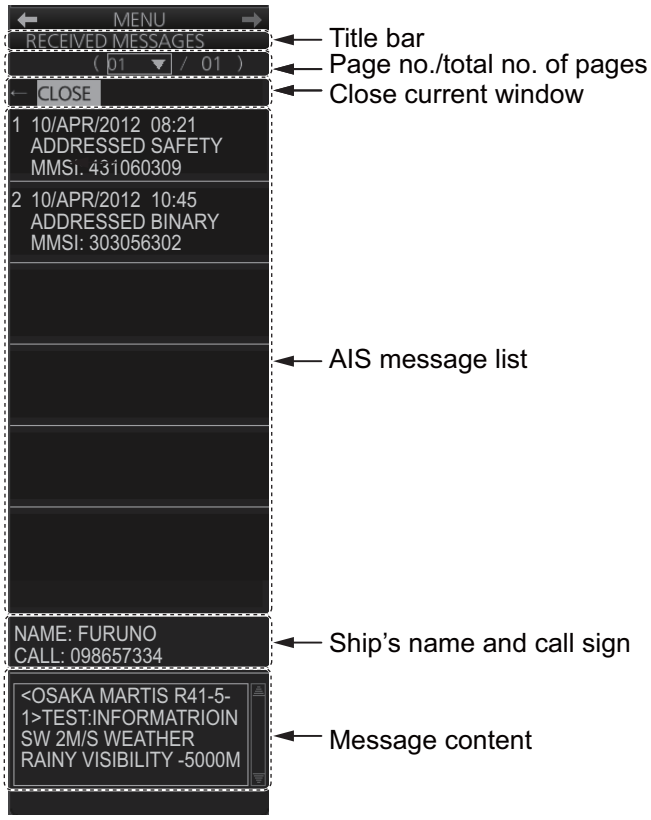
How to display received AIS messages automatically

Right-click the AIS mode indication then click [AIS Menu] to show that menu. Go to page 2 and set [1 AUTO DISP MESSAGE] to [ON]. Then, any received AIS message is automatically displayed.

AIS Received Messages list

Received AIS messages are stored in the AIS received message list. A maximum of 1,200 messages are saved over 12 pages.

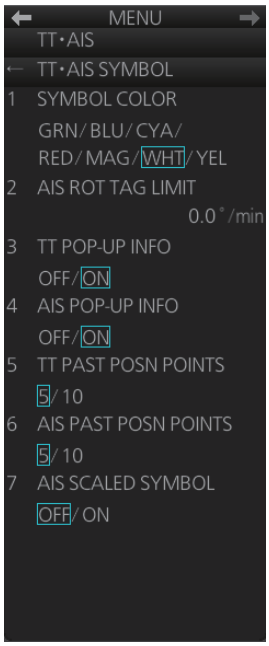
1. Right-click the AIS mode indication then click [AIS Menu] to show that menu.
2. Select [7 RECEIVED MESSAGES].



3. Click an AIS message in the list to show its contents.
4. Click the Close window button to close the window.

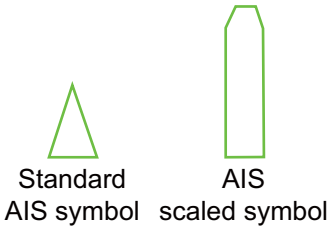
4.17 Other AIS Features

The [TT/AIS] menu additionally provides the features described below.



AIS ROT TAG LIMIT: The ROT marker appears on the heading line of an AIS target and points in the direction of the turn when the ship's rate of turn is greater than that set here.

AIS SCALED SYMBOL: The AIS target symbol can be shown as a simple triangle or a symbol scaled according to a vessels's dimensions. Select [ON] to show the scaled symbol.



Standard AIS symbol

AIS scaled symbol

5. RADAR MAP AND TRACK

5.1 What is a Radar Map?

A radar map is a layer consisting of marks and lines overlaid on the radar display. A map is intended for indicating safety-related areas and objects. Ten radar maps can be made and each map can have a total of 4,000 lines and marks. The map data can be saved to facilitate repeated use on a routine navigation area. The user can create a radar map on-real time while using the radar for navigation or at leisure time at anchor or while the radar is not being used. Waypoints, events and user charts from the chart can be shown or hidden on the radar map display.

The radar map does not affect any radar function.

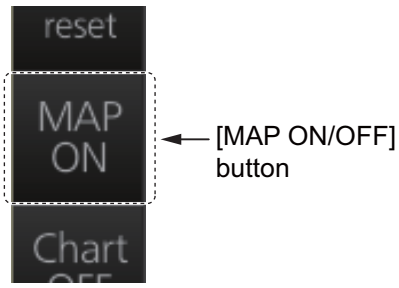
5.2 Presentation Modes

Five presentation modes are available: North-up, Course-up, Head-up, Head-up TB (True Bearing), Stern-up and North-up TM. To select a mode, use the **MODE** key on the Control Unit or click the [Range/Presentation mode] box.

Note: Chart data is not displayed in the head-up and head-up TB modes.

5.3 How to Show, Hide the Radar Map Display

Click the [MAP ON/OFF] button to display [MAP ON] or [MAP OFF] as appropriate.



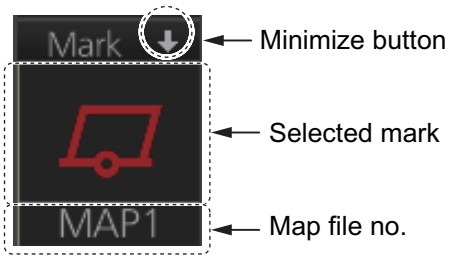
5.4 How to Enter Radar Map Marks and Lines

Marks and lines can be inscribed in the radar mode. (Marks cannot be entered in the chart radar mode.) These marks and lines can be displayed in red, green, blue, cyan, magenta, yellow or white. (Some marks, lines and colors may not be available depending on the specifications of your radar.)

The capacity for map storage is 10 maps/4,000 points per map. When you save 4,000 points to a map, the message "MARK FULL" replaces the mark icon in the [Mark] box and you cannot save any more marks to that map. In this case save the marks/lines to a different map file or erase some marks from the full map file in order to save the mark.

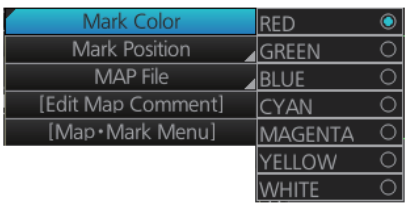
The procedure below shows how to enter a mark, including mark selection, mark entry method, and save location. You can skip steps in the procedure where it is not necessary to complete the corresponding action.

1. Put the cursor on the mark shown in the [Mark] box at the bottom-left position on the display.



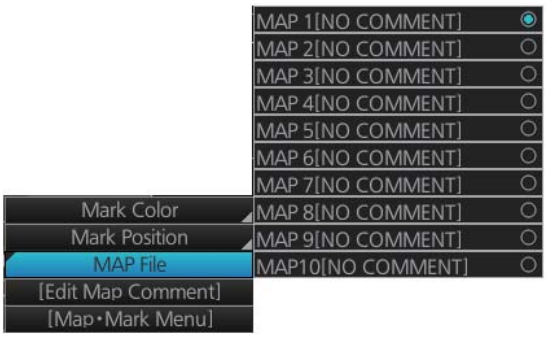
2. Spin the scrollwheel to select a mark. The name of the mark appears to the right of the mark.

3. Select mark color (B-type only), mark position, and where to save the mark as follows:
   1) Right-click the [Mark] box to show the context-sensitive menu then click [Mark Color].



   2) Click the mark color desired.
   3) At the context-sensitive menu, click [Mark Position] to select the mark input method. The choices are [CURSOR], [OWN SHIP] and [L/L].
   For L/L, the mark is inscribed at the L/L position entered at [1 OWN SHIP MARK] on the [Map/Mark] menu.

4) At the context-sensitive menu, click [MAP File] then click the map file number where to save the mark.



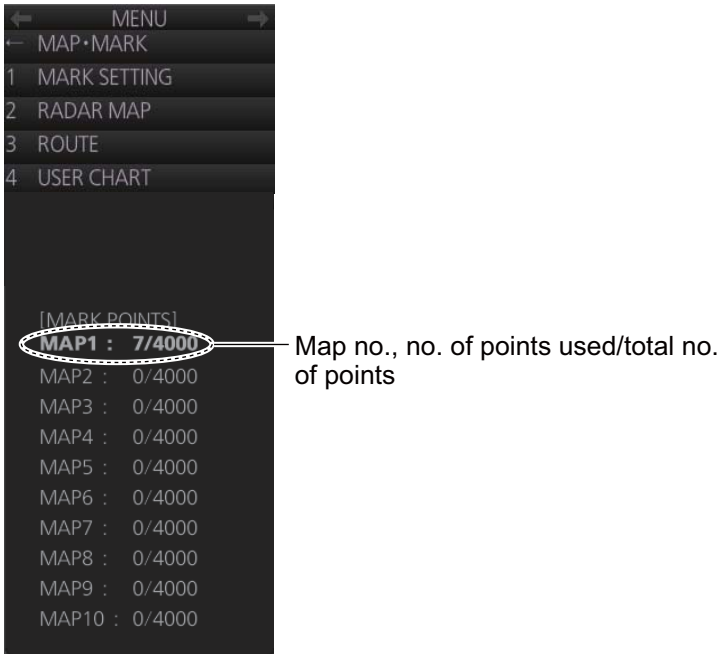
4. **For entry with the cursor,** use the trackball to put the cursor on the location desired. (You can see the range and bearing from own ship to the cursor location by monitoring the Cursor position box.) Push the left button or the **MARK** key on the Control Unit to inscribe the mark or line point.

Note: To continue entering the same mark or line under the same conditions, do the following at the next time of entry.
Entry by cursor: Click the location where to put a mark.
Entry by ship's position, or manual input of latitude and longitude: Click the mark icon.

5.5 How to Find Number of Map Points Used

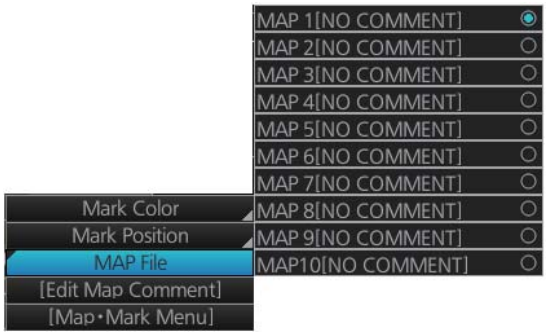
You can show the number of points used in each radar map file.

Right-click the [Mark] box then select [Map/Mark Menu]. See [MARK POINTS] at the bottom of the menu to see how many mark points have been used per map file. In the example below 7 points out of 4,000 points have been used in Map 1.



5.6 How to Select the Radar Map to Display

Right-click the [Mark] box to show the context-sensitive menu. Click [MAP File] and then click the map no. you want to display.

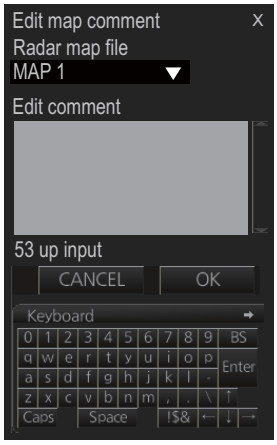


5.7 How to Attach a Comment to a Radar Map, Find Comment for a Map

How to attach a comment to a radar map

You can attach a comment to radar maps you have created, to help you distinguish your maps.

Right-click the [Mark] box to show the context-sensitive menu then click [Edit Map Comment]. A text input box appears together with the software keyboard, as shown in the right figure. Select the map no. with the [Radar map file] drop-down list. Enter your comment in the text input box. The number of characters available appears below the box. Click the [OK] button to finish.



How to find the comment for a map

Put the cursor on the map no. indication. The comment is displayed to the right of the map no. In the example below the comment is "Kobe".

5.8 How to Erase Radar Map Marks and Lines

A total of 4,000 marks and lines is allotted per map. When this amount is exceeded in a map, no more map marks or lines may be entered into the map unless you erase some unnecessary marks or lines.

5.8.1 How to erase individual radar map marks and lines

1. Put the cursor on the mark or line to erase then right-click to show the context-sensitive menu.

2. Click [Mark Delete].

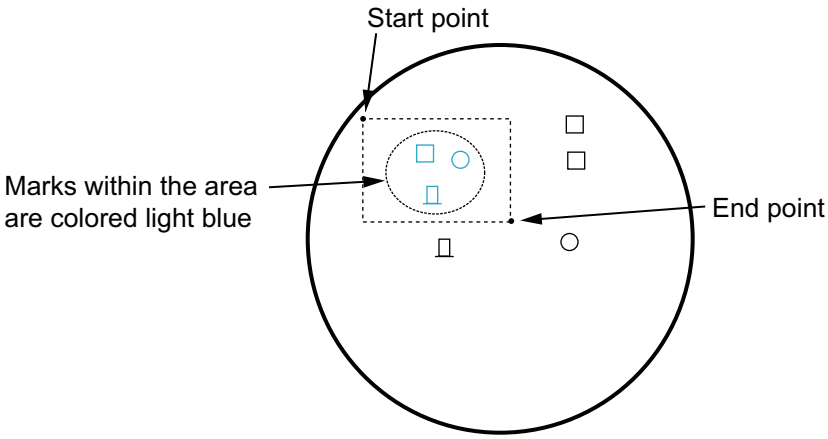
5.8.2 How to erase map marks and lines in an area

You can erase all marks and lines within an area as follows:

1. Right-click the display area to show the context-sensitive menu.

2. Click [Area Select].

3. Specify the area as follows:
   1) Put the cursor on the start point and push the left button.
   2) Drag the cursor diagonally to the end point and push the left button.



All marks and lines within the area selected are highlighted in blue.

4. Right-click the display area to show the context-sensitive menu.
5. Click [Area Mark Delete] to delete the marks and lines in the area selected.

5.8.3 How to erase all radar map marks and lines in a map file

You can erase all radar map marks and lines in the map file currently displayed. Be absolutely sure you want to erase the marks and lines - erased marks and lines cannot be restored.

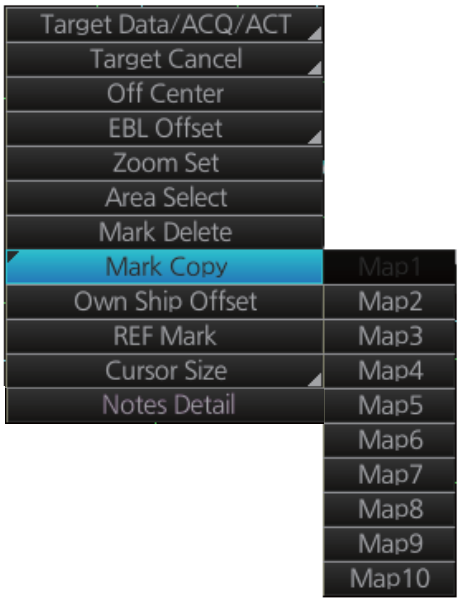
1. Right-click the [Mark] box, select [Map/Mark Menu] and [1 MARK SETTING].
2. Select [8 MAP MARK ALL DELETE] (B type) or [7 MAP MARK ALL DELETE] (IMO and A types).
3. You are asked if you are sure to delete all map marks. Click the [OK] button to erase all marks and lines.
4. Close the menu.

5.9 How to Copy Radar Map Marks and Lines

5.9.1 How to copy individual radar map marks and lines to another map file

You can copy individual marks and lines from the currently displayed radar map to the radar map file of your choice.

1. Right-click the display area to show the context-sensitive menu.
2. Click [Mark Copy] then click the map file no. where to copy the mark.



3. Put the (light-blue) cursor on the mark or line then click.

5.9.2 How to copy radar map marks and lines within an area to another map file

You can copy radar map marks and lines within an area of the currently displayed radar map to the radar map file of your choice.

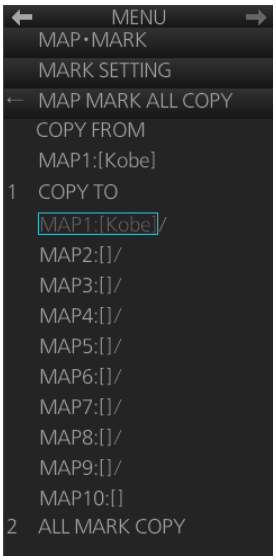
1. Right-click the display area to show the context-sensitive menu.
2. Click [Area Select].
3. Specify the area as follows.
   1) Put the cursor on the start point and push the left button.
   2) Drag the cursor diagonally to the end point and push the left button.
      All marks and lines within the area selected are highlighted in blue.
4. Right-click to show the context-sensitive menu.

5. Click [Area Mark Copy] then click the map file no. where to copy the marks and lines.

5.9.3 How to copy all radar map marks and lines in a map file to another map file

You can copy all radar map marks and lines in the currently displayed radar map to the radar map file of your choice.

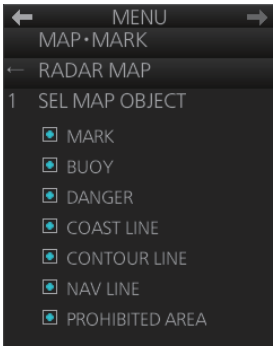
1. Display the map file of which to copy all its marks and lines. See section 5.6.
2. Right-click the [Mark] box then click [Map/Mark Menu].
3. Select [1 MARK SETTING].
4. Select [9 MAP MARK ALL COPY] (B type) or [8 MAP MARK ALL COPY] (IMO and A types).



5. Select [1 COPY TO] then select where to copy the map marks and lines.
6. Select [2 ALL MARK COPY]. You are asked if you are sure to copy all map marks. Click the [OK] button to copy.
7. Close the menu.

5.10 How to Show, Hide Radar Map Features

There are times when you won't require all the map objects you have entered in a radar map. You can show or hide the ones you don't need as follows:



1. Right-click the [Mark] box then select [Map/Mark Menu] and [2 RADAR MAP].
2. Turn objects on or off as appropriate.
3. Close the menu.

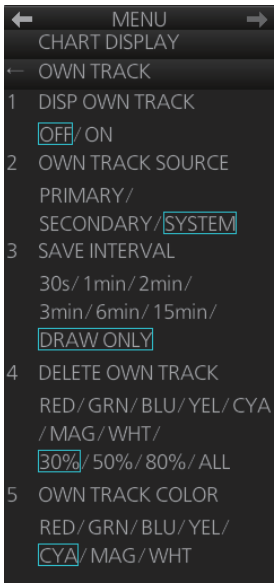
5.11 Track

5.11.1 How to set up ship's track

The track traces your ship's movement. This radar records track at the interval you set on the [OWN TRACK] menu, and the recording interval determines the maximum recording time. The longer the interval the longer the recording time, as shown in the table below.

When the memory for track becomes full, the oldest track is deleted to make room for the latest. For that reason you may want to adjust the recording interval so as to keep the track on the display for a longer time.

Save Interval	Max. Recording Time	Save Interval	Max. Recording Time
30 s	166 hr 40 min	3 min	41 days 16 hr
1 min	13 days 21 hr 20 min	6 min	83 days 8 hr
2 min	27 days 18 hr 40 min	15 min	208 days 5 hr



1. Open the menu then select the [6 CHART DISPLAY] and [1 OWN TRACK] menus.
2. Select [1 DISP OWN TRACK].
3. Select [ON] to show your ship's track or [OFF] to hide the track.
4. Select [2 OWN TRACK SOURCE].
5. Select the navigation sensor that is to feed the position data to use to plot your ship's track, among [PRIMARY], [SECONDARY] and [SYSTEM].
   PRIMARY: Navigation sensor having first priority.
   SECONDARY: Navigation sensor having second priority.
   SYSTEM: Plot own ship's track using system-fed position.
6. Select [3 SAVE INTERVAL].
7. Select how often to save your ship's track, among [30s], [1min], [2min], [3min], [6min] and [15min]. [DRAW ONLY] draws the track but does not save it.
8. **For the B-type radar**, you can select the color for the track with [5 OWN TRACK COLOR].
9. Close the menu.

5.11.2 How to erase track

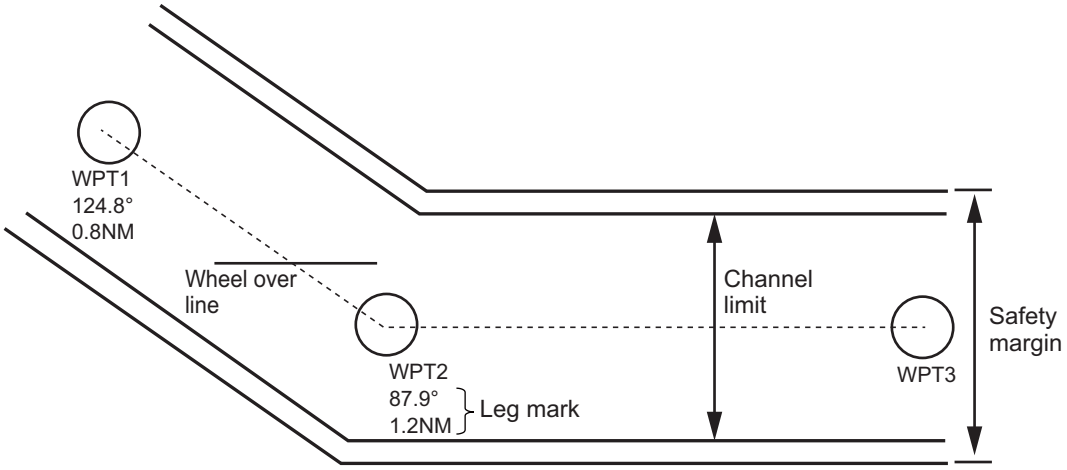
The display may become full of track when, for example, your ship traces the same route several times. In this case you may want to delete some or all of your track from the display.

1. Open the menu then select the [6 CHART DISPLAY] and [1 OWN TRACK] menus.
2. Select [5 DELETE OWN TRACK] (B type) or [4 DELETE OWN TRACK] (IMO and A types).
3. Select the color to delete (B-type only), or the percentage of track to delete among [30%], [50%], [80%] and [ALL].
4. Close the menu.

5.12 Route Display

The route selected for navigation (in the chart mode) can be shown on the radar display. You can show or hide the entire route, and show or hide elements of the route (channel limits, safety margin, leg marks and wheel over line).

1. Right-click the [Mark] box then select [Map/Mark Menu] and [3 ROUTE].
2. Turn the route display on or off at [1 DISP ROUTE].
3. Turn the channel limit, safety margin, leg marks and wheel over line displays on or off at [2 SEL ROUTE OBJECT].

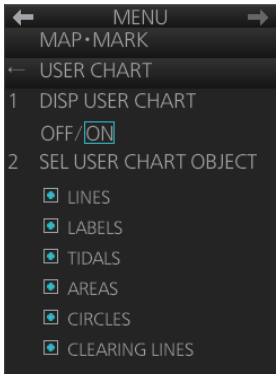


4. Close the menu.

5.13 User Chart Display

The active user chart can be shown in the chart radar mode. See chapter 13 for a description of the user chart.

1. Right-click the [Mark] box then select [Map/Mark Menu] and [4 USER CHART].
2. Show or hide the user chart on the radar display with [1 DISP USER CHART].
3. Show or hide the user chart objects on the radar display with [2 SEL USER CHART OBJECT].
4. Close the menu.



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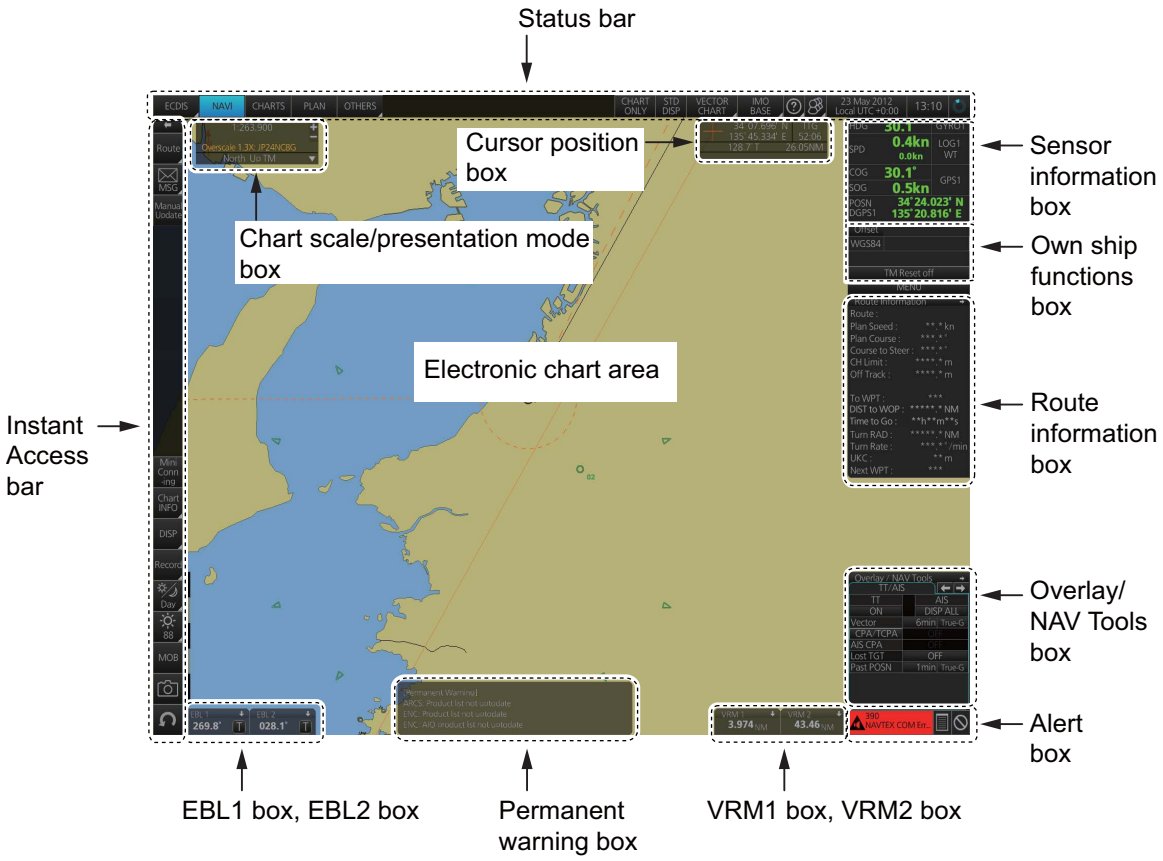
6. CHART OVERVIEW

6.1 Chart Screen Overview

The chart screen is divided into several areas, as illustrated below.



- The **Status bar** provides for selection of operating mode, chart format, IMO chart display; one-click restoration of IMO standard display, etc.
- **The Sensor information box** displays ship's speed, course and position and selects sensors.
- **The Own ship functions box** applies offset to the chart.
- The **Route information box** shows route and waypoint data, when a route is selected for navigation.
- The **Overlay/NAV Tools** box provides for setup of navigation-related functions.
- The **Alert box** shows operational and system alert messages.
- The **VRM boxes** measure the range to an object.
- The **Permanent warning box** displays chart-related warning messages.
- The **EBL boxes** measure the bearing to an object.
- The **InstantAccess bar** provides quick access to functions such as brilliance adjustment, display palette and the chart-related menu. The contents change according to the operating mode selected.
- The **Chart scale/presentation mode box** selects the chart scale and presentation mode.
- The **Cursor position box** shows the latitude and longitude position of the cursor and the TTG to the cursor.
- The **Electronic chart area** shows the chart.

6.1.1 Electronic chart area

This chart radar can use the following types of charts:

- S-57 (IHO)
- S-63 (IHO) (S-63 encrypted)
- CM-ENC (C-MAP by Jeppesen)
- CM-93/3 (C-MAP by Jeppesen)

The following information can also be displayed:

- Cursor (moved by trackball)
- Planned route
- EBL (Electronic Bearing Line) and VRM
- Own ship symbol with speed vector
- TT-acquired target
- AIS target

Electronic charts

The electronic navigational charts, S57ed3 ENC or CM-93 vector format, are displayed in the electronic chart area.

The chart radar combines chart and navigational information. It should be noted that modern navigation systems (e.g., differential GPS) may offer more accurate positioning than what was used to position some of the surveys from which the electronic navigational chart was derived.

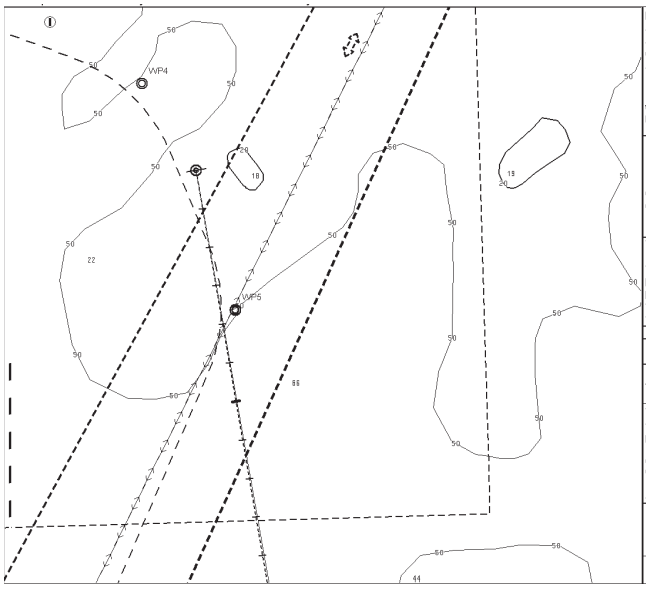
S57 vector format

This chart radar is compatible with S57 release 3 ENC format charts. ENC charts are converted to SENC for use with the chart radar.

When you open a chart, it is displayed with the default scale, called the compilation scale. The details for the chart are displayed in the electronic chart area and these can be modified. You can change the chart scale with the ZOOM IN and ZOOM OUT functions, and the scale range is 1:1,000 - 1:70,000,000.

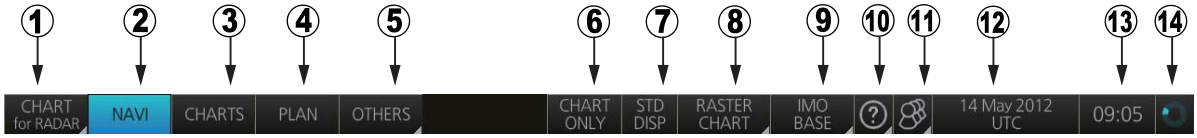
CM-93: Compatibility with CM-93 format depends on commercial agreements. Some versions of this chart radar are compatible and others are not. A security device called a dongle (the dongle for the FEA-2xx7 series can also be used, contact FURUNO for details) controls the compatibility. From CM-93 format the chart radar generates SENC charts for use with the chart radar. The difference between S57ed3 ENC charts and CM-93 charts is that the CM-93 charts are from a private source and they cannot be used as a substitute for paper charts under any condition. To emphasize this point these charts are called "Non-ENC" charts in this manual.

CM-ENC: C-MAP produced official ENC chart that complies with the IHO's (International Hydrographic Organization's) S-57 Edition 3 product specification. When used in the chart radar, the ENC data improves the safety of navigation at sea.



6.1.2 Status bar

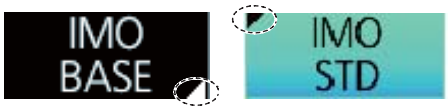
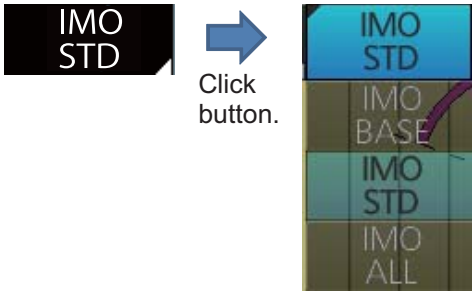
The Status bar mainly provides for selection of operating mode, chart type and IMO chart display setting.



No.	Button name	Description
1	Operating mode	Selects the operating mode: Radar, or Chart for Radar.
2	NAVI	Selects the Voyage navigation mode.
3	CHARTS	Goes to the Chart maintenance mode.
4	PLAN	Selects the Voyage planning mode.
5	OTHERS	• Plays back log. • Sets system in standby.
6	CHART ONLY	Shows only the chart, when left button is pressed and held down.
7	STD DISP	Restores the IMO standard display instantly.
8	Chart priority	No use.
9	Chart database	Selects the pre-defined presentations of ENC content: IMO BASE, IMO STD or IMO ALL. CUSTOM appears when the symbols selected or de-selected on the [Chart Display] menu do not match the preset conditions for IMO BASE, IMO STD or IMO ALL.
10	?	Displays the operator's manual, chart (ECDIS) program no. and system information.
11	Settings	Manages user profiles; opens the Settings menu.
12	Date	• Displays the date. • Selects the time to use, local or UTC. • Sets the time difference between local and UTC (to use local time).
13	Time	Time (local or UTC)
14	Spinner	Rotates clockwise if the system is working properly. If it is not spinning the system is not working. Shortly after it stops spinning the buzzer sounds. Reset the power to restore normal operation.

How to operate the buttons on the Status bar

There are two types of buttons on the Status bar: Toggle button and Drop-down list button. You operate the buttons with the trackball module.

Button type	Operating procedure
Toggle button	
A toggle button alternately selects one of two functions assigned to the button. The background color of a toggle button is light-blue when the button's function is enabled; gray when disabled. The [NAVI] button is an example of a toggle button.	 *OFF (gray)* *ON (light-blue)*
Drop-down list button	
A drop-down list button provides a drop-down list from which to select an option related to the label on the button. The [Chart Database] button is an example of a drop-down list button. See the right figure. A drop-down list button has a list status indicator whose position changes according to list status.  *List closed* *List opened*	

6.1.3 InstantAccess bar

The InstantAccess bar contains all the operating functions related to the chart operating mode (Voyage planning, Voyage navigation and Chart maintenance) selected. The bar is divided into two sections, upper and lower. The buttons in the upper section change according to the mode selected. The buttons in the lower section are static for all modes, with the exception of the [Mini Conning] button, which is available in the Voyage navigation mode.

Voyage navigation mode bar

Chart maintenance mode bar

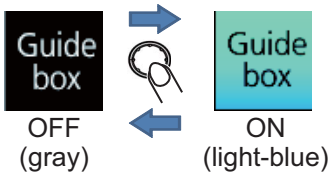
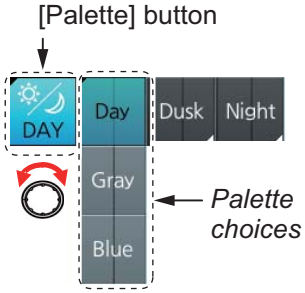
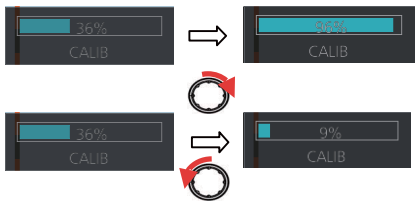
Voyage planning mode bar

Button name	Description
Voyage navigation mode bar	
←	Minimize the InstantAccess bar. To restore the maximized bar, click anywhere on the bar. 
Route	Route functions: select route, deselect route, move route to plan, monitor route.
MSG	Processes AIS Safety and Navtex messages.
Manual Update	Shows the menu for manual update of chart objects.
Mini Conning	Shows, hides the mini conning display, available in the Voyage navigation mode.
Chart maintenance mode bar	
←	Minimizes the InstantAccess bar.
AUTO Load	Loads charts automatically.
Manage Charts	Deletes charts; installs charts manually.
Cell Status	Finds cell status.
License	Enters license information.
Public Key	Shows the current public key. The public key changes each time a new one is installed.
Voyage planning mode bar	
←	Minimizes the InstantAccess bar.
Planning	Creates and edits routes and user charts.
Report	Displays route and user chart reports.
Guide Box	Shows or hides the guide box, which provides range and bearing measurement between waypoints when creating a route (in the chart mode).
Manage Data	**Route**: Deletes routes. **User Chart**: Deletes user charts. **Data Import**: Imports route, user chart created with FEA-2x07 ECDIS.
Common bar	
Chart INFO	**Chart Legend**: Shows chart legend. **Viewing Dates**: Set Display date and Approved until dates. **Chart 1**: Displays overview of ECDIS chart symbols.
DISP	**SET:** Shows the [Chart Display] menu, [Symbol Display] menu, [Chart Alert] dialog box. **TWO DISP:** Dual displays, tiled vertically or horizontally, in the Voyage navigation mode. **AIO:** Shows, hides the AIO overlay. **Keyboard:** Shows, hides the software keyboard.

Button name	Description
Record	Displays Event log (user event, POSN event), NAV log (Voyage, Details, Chart Usage), Target log (Danger Target).
(Palette)	Selects a color palette, day, dusk or night.
(Brilliance)	Adjusts the brilliance of a FURUNO monitor unit.
MOB	Inscribes the MOB (ManOverBoard) mark.
(Capture)	Takes a screenshot.
(Undo)	Restores previous condition in route and user chart creation.

How to operate the buttons on the InstantAccess bar

The InstantAccess bar has four types of buttons: toggle button, drop-down list button, slider bar button, and speciality button. (The MOB, Capture and Undo buttons are specialty buttons that provide a single-action function.) The buttons can be operated with the trackball module or the **InstantAccess** knob. This section shows you how to operate the buttons with the **InstantAccess** knob.

Toggle button	Drop-down list button	Slider bar button
		

1. Push the **InstantAccess** knob to enable its use with the InstantAccess bar.
2. Rotate the **InstantAccess** knob to select a button. The background color of the button selected is light blue.
3. Do one of the following depending on button type.
   1) **Toggle button**: Push the knob to select setting.
   2) **Drop-down list button** or **slider bar**: Rotate the knob to select an item or adjust the slider bar. Push the knob to confirm your selection or setting.
      Note 1: You can use the **ESC** key to go back one step in the current operating sequence.
      Note 2: The **InstantAccess** knob can only adjust the slider bar on the InstantAccess bar.

6.1.4 Sensor information box

The sensor, chart information box displays various sensor data and chart information. When the user-selected sensor fails, the system automatically selects another sensor. When this occurs, the color of the sensor name changes from green to yellow. For details, see section 1.8.

6.1.5 Own ship functions box

The own ship functions box shows information about own ship, enables offset and TM reset.

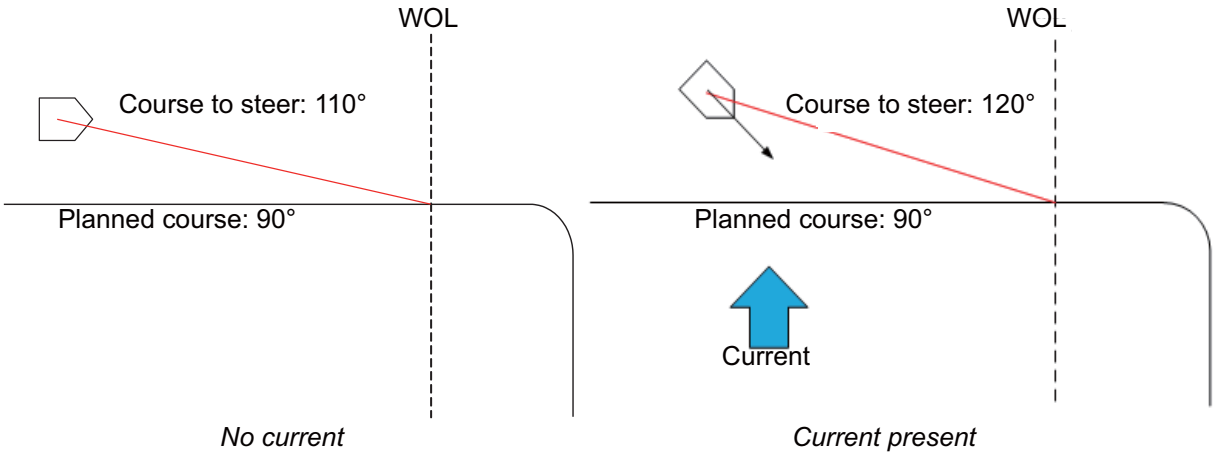
- **[Offset]** button: See section 16.8.1.
- **ENC info**: ENC chart info appears here.
  No indication: ENC chart is currently displayed.
  "ENC data available": Currently, RNC chart is shown, but ENC chart is available.
  "Non-ENC data": Non-official ENC material, in yellow characters. See section 7.12.
- **RNC info**: "RNC data" appears (in yellow) when raster chart is in use.
- **TM/CU status**:
  "TM/CU Reset": True motion reset is active. (Chart is stationary and own ship moves on the chart.)
  "TM Reset off": When dragging the chart; true motion is OFF. To restart true motion, click the indication,
  "Ship off screen": Ship is out of the display area.

6.1.6 Route information box

Asterisks appear in data locations when no route is selected for navigation.

- **Route**: Name of monitored route.
- **Plan Speed:** Planned speed to approach "To WPT".
- **Plan Course:** Planned course between previous WPT and "To WPT".
- **Course to Steer:** Calculated set course to follow the monitored route, including off track, drift and gyro error compensation.
- **CH Limit:** Planned width of channel to approach "To WPT".
- **Off Track:** Perpendicular distance the ship is from the intended track.
- **To WPT:** The waypoint that the ship is approaching.
- **DIST to WOP (Wheel Over Point):** Distance to the point where rudder order for course change at "To WPT" is given.
- **Time to Go:** Time to go to WOP (hh:mm:ss).
- **Turn RAD:** Planned turning radius at "To WPT".
- **Turn Rate:** Calculated rate of turn that is based on current speed and planned turning radius.
- **UKC:** Under keel clearance set for "To WPT".
- **Next WPT:** The WPT following the "To WPT".

Course to steer

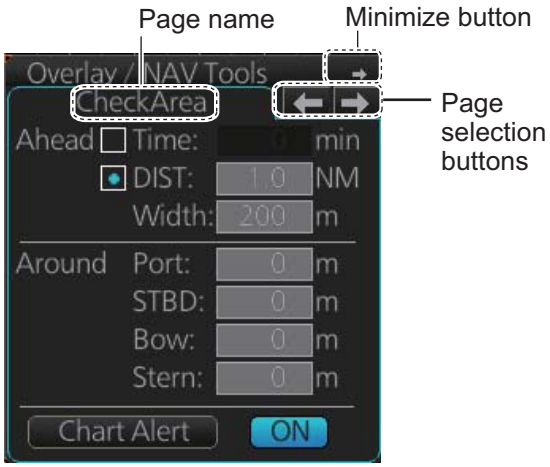


6.1.7 Overlay/NAV Tools box

The [Overlay/NAV Tools] box sets up the following objects and consists of the following pages.

- TT/AIS
- Parallel index lines
- Range rings
- Predictor (predicts ship's future movements)
- Under the keel clearance graphic
- Anchor watch
- Check area

See chapter 15 for information about objects other than TT/AIS.

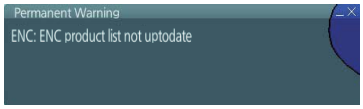


6.1.8 Alert box

The [Alert] box shows operational and system alert messages, with alert ID no. and alert message. See chapter 20.

6.1.9 Permanent warning box

The permanent warning box displays chart-related warning messages. The box cannot be closed or minimized.

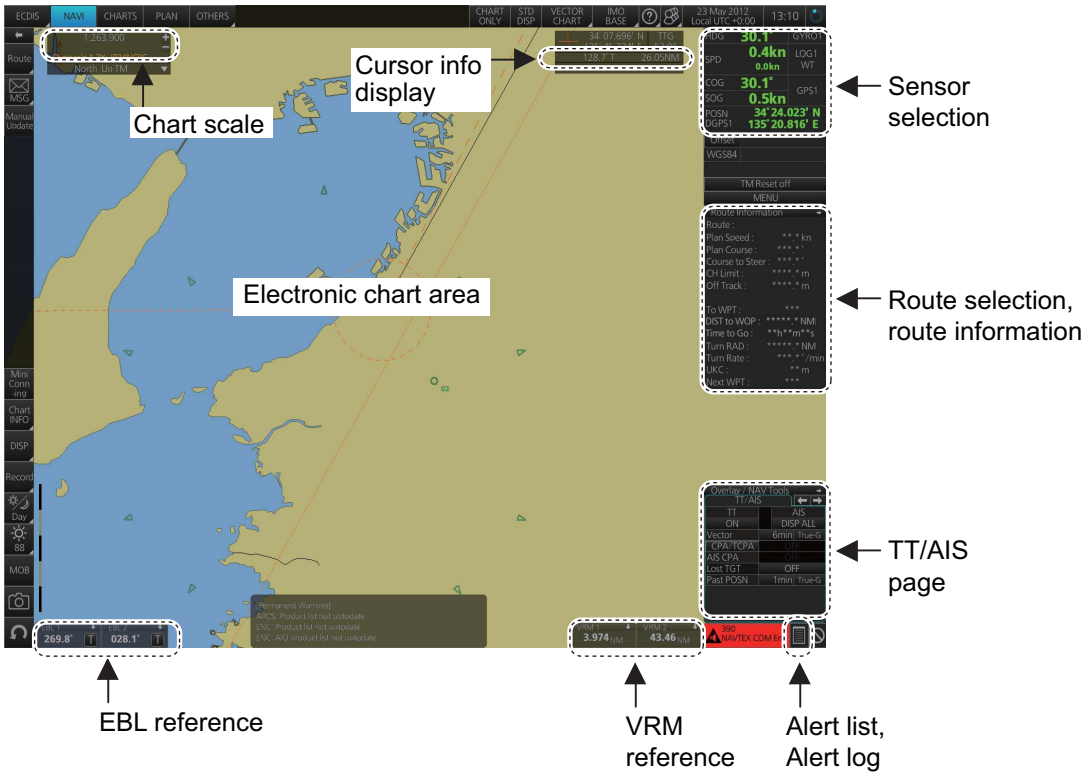


6.1.10 EBL, VRM boxes

The EBL measures the bearing to an object, and the VRM measures the range to an object. See section 6.4.

6.1.11 Context-sensitive menus

Context-sensitive menus are available at the locations shown below. Right-click the applicable area then select the appropriate item from the menu. The availability of the context-sensitive menu depends on the mode in use, as shown in the table below.



Item	Functions	Mode and availability		
		NAVI	CHART	PLAN
Chart scale	Drop-down list of chart scales.	Yes	Yes	Yes
Cursor info display	Switch cursor displays.	Yes	Yes	Yes
Sensor selection	Select sensors.	Yes	Yes	Yes
Route selection, route information	Select route; unselect route; move route to plan; show route info.	Yes	No	No
TT, AIS page	Access TT, AIS functions.	Yes	Yes	Yes
Alert list, Alert log	Open alert list, alert log.	Yes	Yes	Yes
VRM reference	Select VRM reference; offset (heading or north).	Yes	Yes	Yes
EBL reference	Select EBL reference; offset (heading or north).	Yes	Yes	Yes
Electronic chart area	Off center position, return position to screen center; object info; chart legend; manual update; hide MOB.	Yes	No	Yes*

* Hide MOB only

6.1.12 How to enter alphanumeric data

On some screens it is necessary to enter alphanumeric data. The data can be input two ways: software keyboard or trackball.

Alphanumeric data entry from the software keyboard

A software keyboard is also available for entry of alphanumeric data. Do as follows to use the software keyboard. Display the keyboard before opening menus.

1. On the InstantAccess bar, press the [DISP], [ ] and [ON] buttons to show the software keyboard. The [BS], [Enter], [↑], [↓],[←], [→] and [Spacebar] on the keyboard function the same as those keys on the keyboard of the Control Unit.

2. To switch between the alphabet keyboard and symbols keyboard, click the [!$&] key.

Alphabet keyboard

Symbols keyboard

3. Click the input box.
4. Click appropriate keys and finally click the [Enter] key.

To erase the software keyboard, click the X button at the top right corner of the keyboard.

Alphanumeric data entry with the trackball module

The trackball module can also be used to enter alphanumeric data.

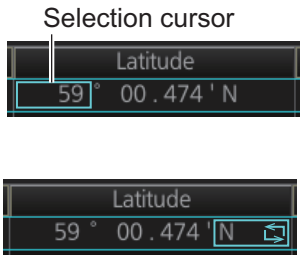
1. Put the cursor in the input box. Up and down arrows appear at the right side of the box.

2. Enter data by one of the methods shown below.
   - Spin the scrollwheel to set data. Upward to decrease the value; downward to increase the value.
   - Click ▲ to increase the value; ▼ to decrease the value.

How to enter latitude and longitude data with the trackball module

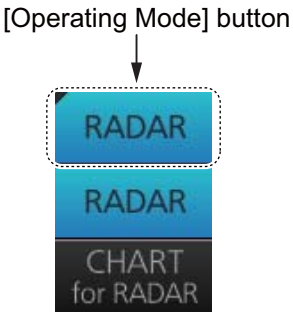
The trackball module can also be used to enter latitude and longitude data.

1. Put the cursor in the input box. A selection cursor (light-blue) appears.
2. Enter data by spinning the scrollwheel. Upward to decrease the value; downward to increase the value.
3. To switch coordinate between N and S and vice versa, put the cursor at the right edge of the input box. Dual arrows appear
4. Click to switch the coordinates. The method to switch E to W and vice versa is the same.



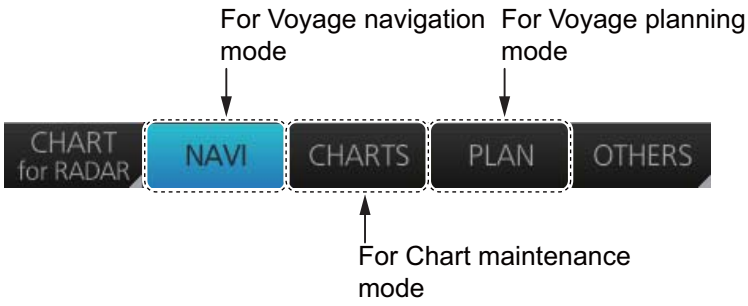
6.2 How to Select the Operating Mode

Click the [Operating Mode] button at the far left side of the Status bar then click [CHART for RADAR] to activate the chart mode.



6.3 How to Select the Chart Operating Mode

The chart display has three chart operating modes: Voyage navigation, Chart maintenance and Voyage planning. Select a mode from the Status bar with the [PLAN], [CHARTS] and [NAVI] buttons. The background of the button of the active mode is blue.

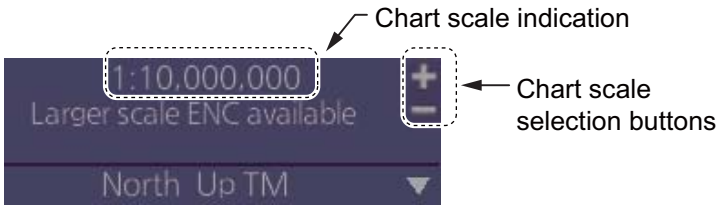


Note: When switching between the Voyage navigation and Chart maintenance modes it may take several minutes to read the chart when using C-Map charts or there are many charts installed.

6.4 How to Select the Chart Scale

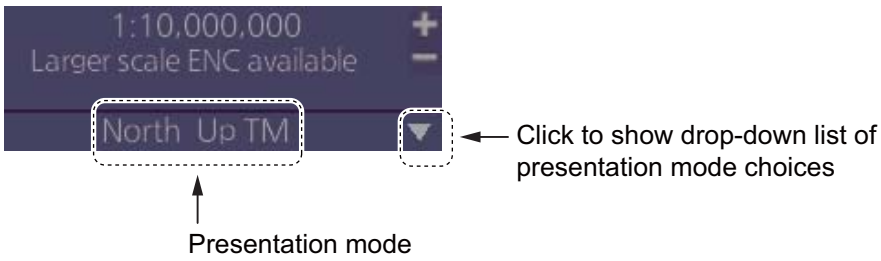
When you open a chart it is displayed with the default scale, called the compilation scale. To change the chart scale, click the chart scale selection buttons in the Chart scale/presentation mode box, or right-click anywhere inside the box to show a drop-down list of chart scales. The scale range is 1:1,000 to 1:70,000,000.

If a location in the chart area is available with more detail, the message "Larger scale ENC available" appears. The status of TM reset determines the area that generates the message. If TM reset is ON, the message appears if more detail is available at current position. If TM reset if OFF, the message appears if more detail is available at the cursor location.



6.5 How to Select the Presentation Mode

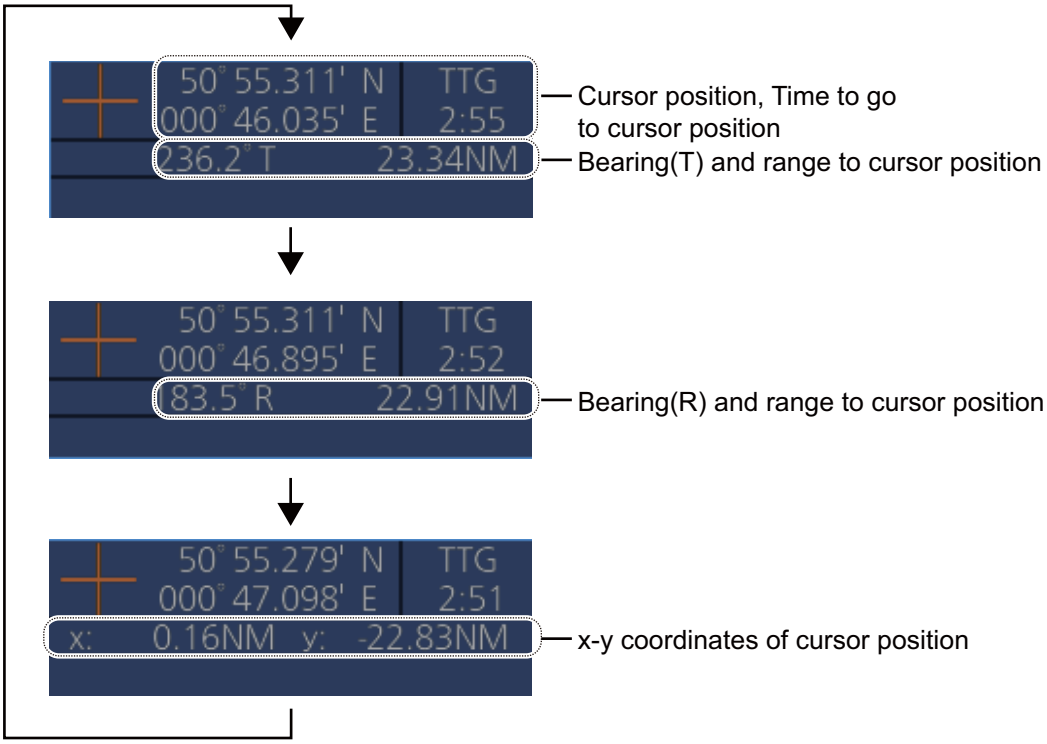
The presentation mode is available in North-up TM, North-up RM, Course-up TM, Course-up RM, Route-up RM and Head-up RM. To select a presentation mode, click the presentation mode indication to cycle through the presentation mode choices or click the triangle to show the drop-down list of presentation modes.



6.6 Cursor Position Box

The Cursor position box shows

- Cursor position in latitude and longitude
- Time to go to the cursor position
- The bearing (True or Relative) and range to the cursor position, or x-y coordinates of cursor position. Click the bearing and range indication or x-y coordinates indication to switch the indication, in the sequence shown below.



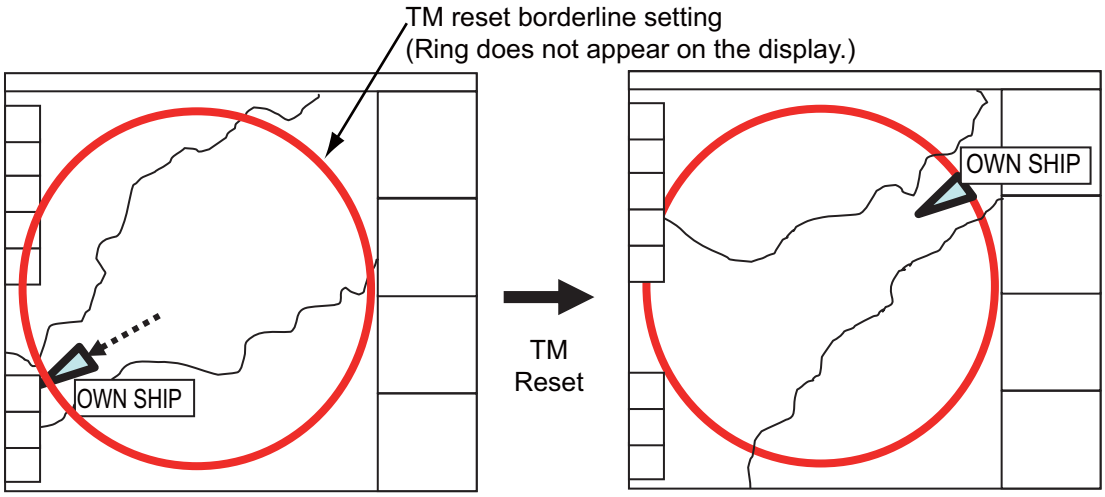
6.7 The Standby Mode

The standby mode deactivates the audio alarms from the chart display. Use it while in harbour or other similar situation where use of the chart is not required. To go to the Standby mode, click the [OTHERS] button on the Status bar then click [STANDBY].

To return to normal operation, click [Back to Normal Mode].

6.8 True Motion Reset

In the true motion mode, the chart is stationary and own ship moves on the screen. With TM reset active, own ship moves until it reaches the true motion reset borderline(s), then the chart is redrawn and own ship jumps back to an opposite position on screen based on its course. (This resetting can also be done manually by clicking the [TM/CU Reset] button.) When the TM reset function is active, "TM/CU Reset" appears at the right side of the display.



How to enable, disable automatic TM reset

To enable automatic TM reset, click the [TM Reset off] indication at the right side of the display to show [TM/CU Reset].

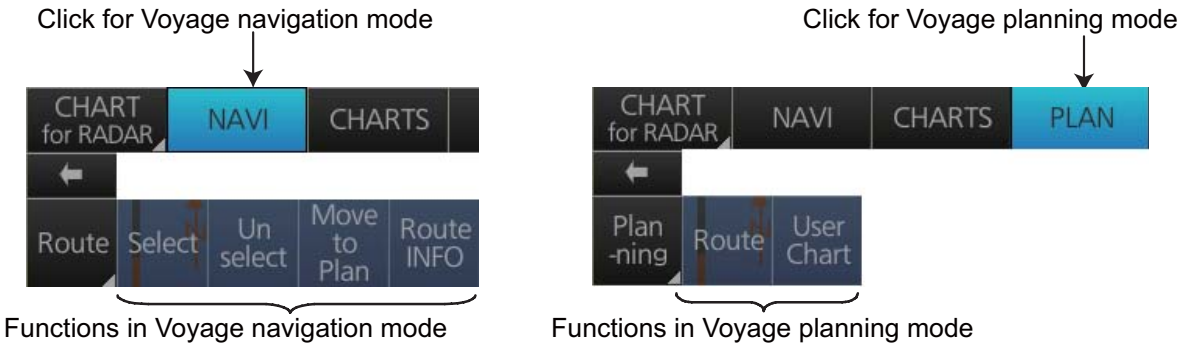
Click

When the TM reset is disabled, change the chart scale with the scrollwheel and scroll the chat by drag and drop. The own ship information box shows [TM Reset off]. When own ship moves off the screen the box shows [Ship off screen].

How to set the true motion reset borderline

You can set the limit for TM reset (in percentage) on the [Basic Setting] page. See section 8.2.2.

6.9 How to Control Route and User Charts in Voyage Navigation and Voyage Planning Modes

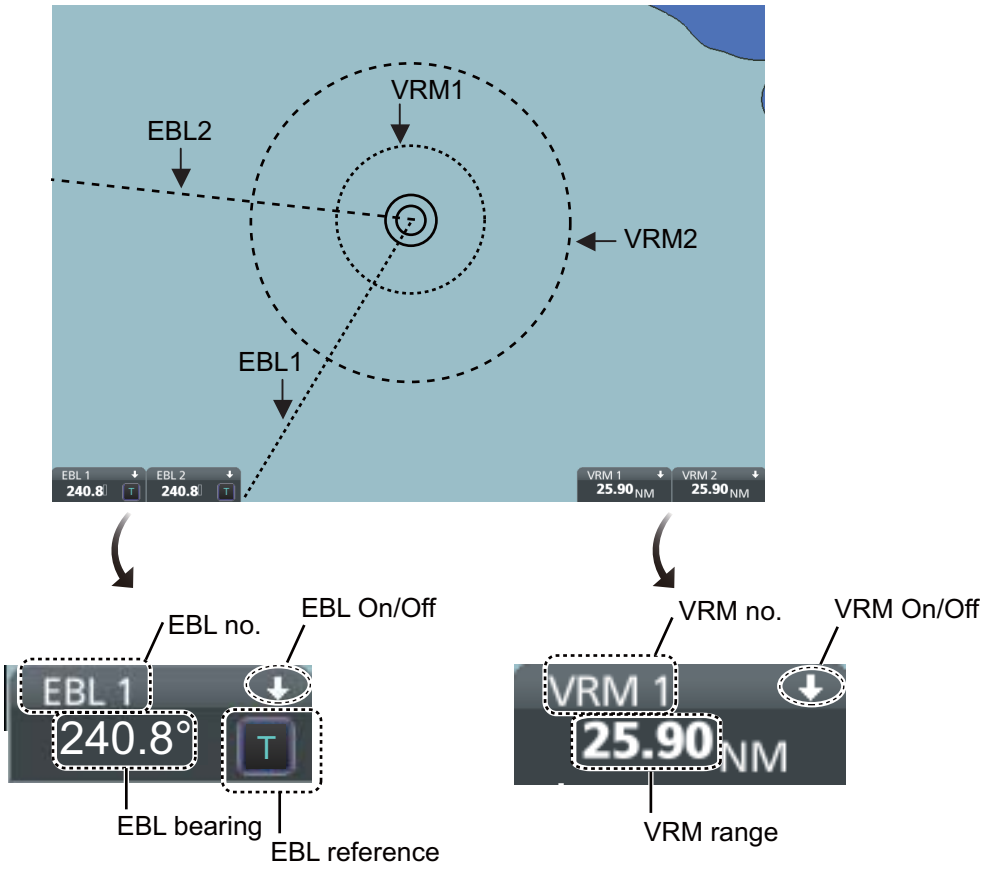


Click the appropriate chart mode button [PLAN] or [NAVI] at the top of the display to go to respective mode. For the Voyage navigation mode, click the [Route] button then click the button corresponding to the action to take. For the Voyage planning mode, click the [Planning] button followed by the [Route] button to select a route, or [User Chart] button to select a user chart.

Voyage navigation mode functions	Voyage planning mode functions
Select: Selects the route to use in the Voyage navigation mode.	**Route:** Shows the [Route Plan] dialog box to create or edit a route.
Unselect: Deselects active route.	**User Chart:** Shows the [User Chart] dialog box to create or edit a user chart.
Move to Plan: Moves active route to Voyage planning mode.	
Route INFO: Shows the [Route Information] dialog box.	

6.10 How to Use the VRM and EBL

The VRM measures the range to an object and the EBL measures the bearing to an object. There are two each of VRMs and EBLs. The lengths of the dashes on the EBL2 and VRM2 are longer than those of the EBL1 and VRM1 to distinguish them. The color of the VRMs and EBLs is orange.



6.10.1 How to hide/show an EBL, VRM

Control Unit: Press EBL or VRM key to hide or show respective marker.
Trackball: Click the arrow on an EBL or VRM box to hide the respective marker. To redisplay the marker, click the minimized box.

6.10.2 How to measure the range and bearing

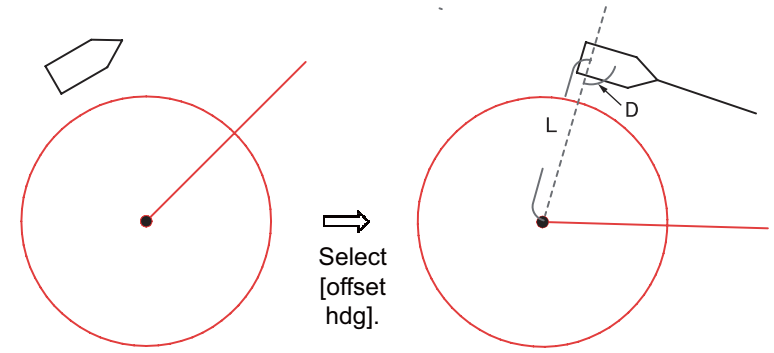
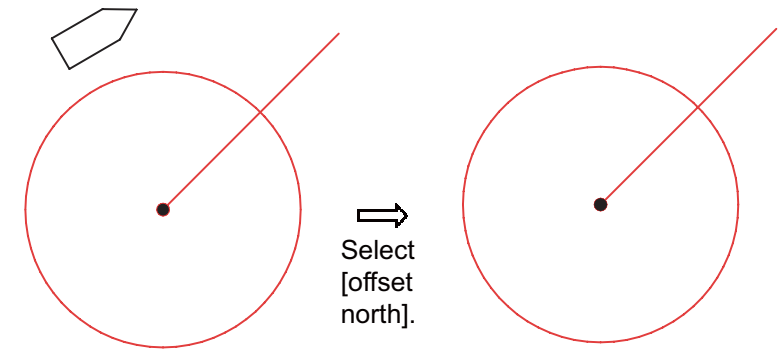
Range: Put the cursor on the VRM then drag the cursor until the VRM is on the inner edge of the object.
Bearing: Put the cursor on the EBL then drag the cursor until the EBL bisects the object.

6.10.3 How to select bearing reference

The EBL bearing reference can be true or relative. Click the EBL reference indication to display T (True) or R (Relative).

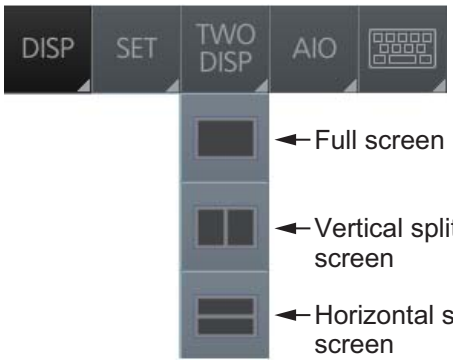
6.10.4 EBL, VRM functions available with the context-sensitive menu

The EBLs and VRMs have additional functions that are accessed from the context-sensitive menu. Right-click any VRM or EBL box to show the context-sensitive menu.

Function	Description
centered	Centers the origin of the EBL and VRM on the current position.
ground	Anchors the EBL and VRM to ground; neither the EBL or VRM move with ship's movement.
offset hdg.	 Drag and drop EBL, VRM on desired location. When vessel changes course, the EBL, VRM move so that the range (L) and angle (D) to their centers stays fixed.
offset north	 Drag and drop EBL, VRM on desired location. The EBL, VRM move to keep the angle from North to the center of the EBL, VRM, even if the vessel changes course. The distance to the center of the EBL, VRM is fixed.

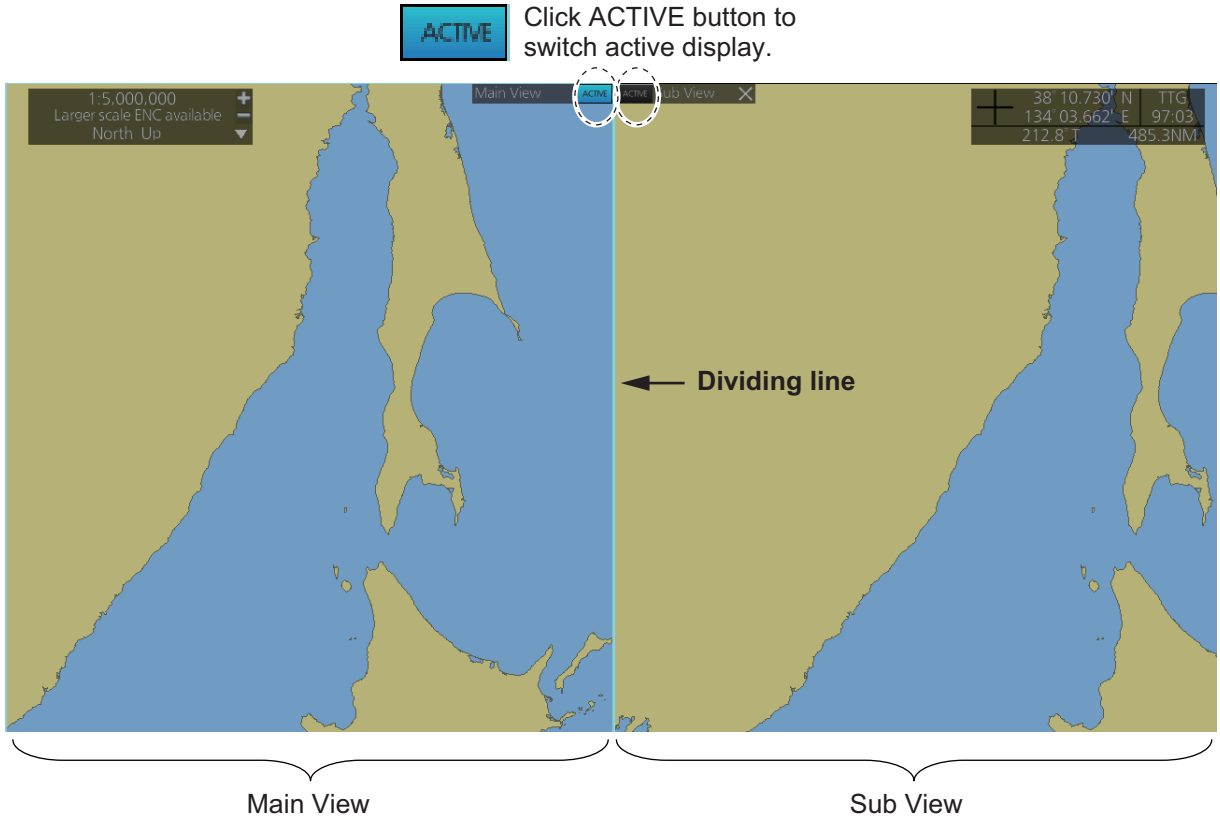
6.11 Split Screen

You can split the screen in two, horizontally or vertically, in the Voyage navigation mode.



To activate the split screen or return to the full screen, click the [DISP] and [TWO DISP] buttons on the InstantAccess bar to show the choices for screen division. Click the screen division desired.

The example below shows the vertical split screen.The orientation mode and the range for the sub view are fixed to those in use before splitting the screen. The active display can be switched by clicking an [ACTIVE] button at the top of the display. The dividing line between the main and sub views cannot be moved.



Note 1: The display may not be updated when switching to the Voyage planning mode. If this occurs, switch to the Voyage navigation mode, restore the split screen display then return to the Voyage planning mode.

Note 2: The own ship mark may not appear at the screen center when releasing the split screen display. If this occurs, click the indication T[M/CU Reset] at the top right position on the screen to show the own ship mark at the screen center.

6.12 Datum

6.12.1 General

Datum is a mathematical model of the earth based on which a sea chart is produced. If the datum of a position sensor and that of a sea chart are different, a transformation has to be made somewhere in the system. Not doing so can result in errors of several sea miles. The difference between two datum is never constant, but depends on position. This means that the difference between WGS-84 and local datum, generally used in paper charts, is not generally valid with electronic sea charts.

6.12.2 Paper charts

Datum used in paper charts have been traditionally national datum for historical reasons. Many paper charts do not have a marked datum, therefore compatibility with electronic charts may be complicated. In some paper charts, the correction terms are printed in lieu of datum, for correction of the WGS-84 system satellite locations. The correction terms are usable but only with the paper chart in question.

6.12.3 Electronic sea charts

The ENC vector material has to be produced by a National Hydrographic Office in the WGS-84 datum.

6.12.4 Positioning devices and datum

In early days of electronic positioning devices, datum received little attention because the commonly used systems utilized special charts (like Decca charts). Later on, data output was added to these systems, but still no attention was paid to datum and the position errors were considered as an inaccuracy of the system. With the spread of the GPS, however, datum has become better known. An accurate position is of no value if co-ordinates are in a wrong datum. GPS satellites utilize the WGS-84 datum.

6.12.5 Chart radar and datum

The chart radar uses ENC material, produced to standards using WGS-84 datum. Positioning devices connected to the chart radar must work in the WGS-84 datum. IMO requires that the chart must give an alert if the datum of a positioning device is not the WGS-84.

6.13 Set up Before Departure

6.13.1 Updates before departure

Update S57 chart material

Update your S57 chart material before embarking on a new voyage. See section 7.13.

Display and approve dates for S57 charts and manual updates

Note: It is very important that you set the Display and Approve dates for charts as the current date.

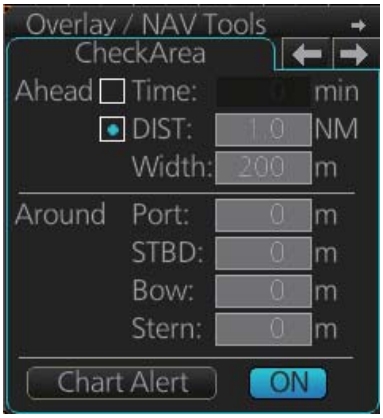
There may be features that require chart viewing dates or seasonal dates in charts. Accordingly, if you have not set Display date and Approved until dates as the current date there is a possibility that you can get a wrong presentation or some feature may be absent. See section 9.3.

Create or update user chart, Notes

If necessary, create a new user chart and Notes or modify existing ones. See chapter 13.

Chart alert calculation

Set chart alert areas suitable for your coming voyage, on the [Check Area] page in the [Overlay/NAV Tools] box. See section 11.2.



6.13.2 Create or update a route

Create a new route or modify an existing one. See chapter 12.

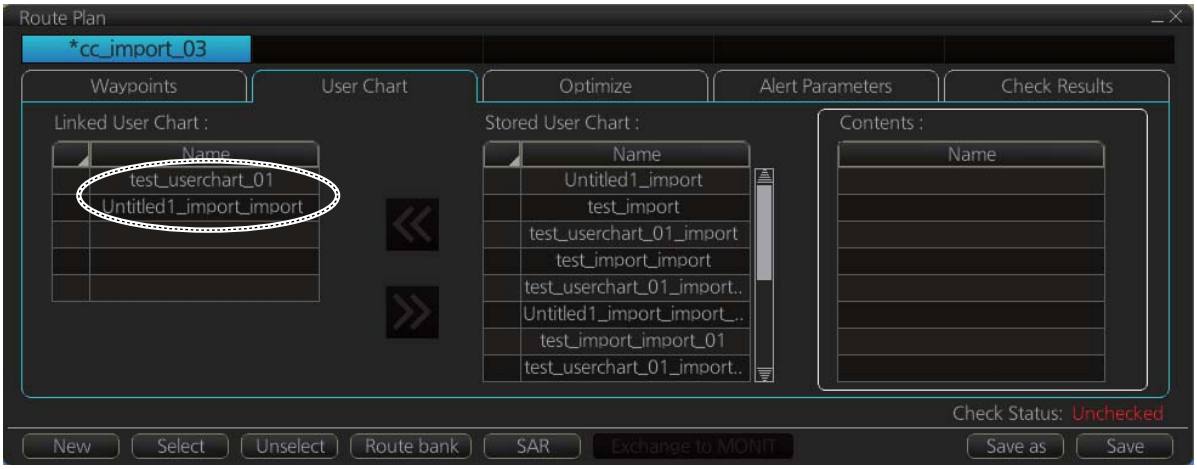
Check your route against chart alerts

Before you sail your route, you should always check your route against chart alerts. This is important because your S57 charts and manual updates may contain chart viewing dates information. You can check chart alerts from the [Check Results] page on the [Route Plan] dialog box.

The following information is stored with the monitoring route plan:

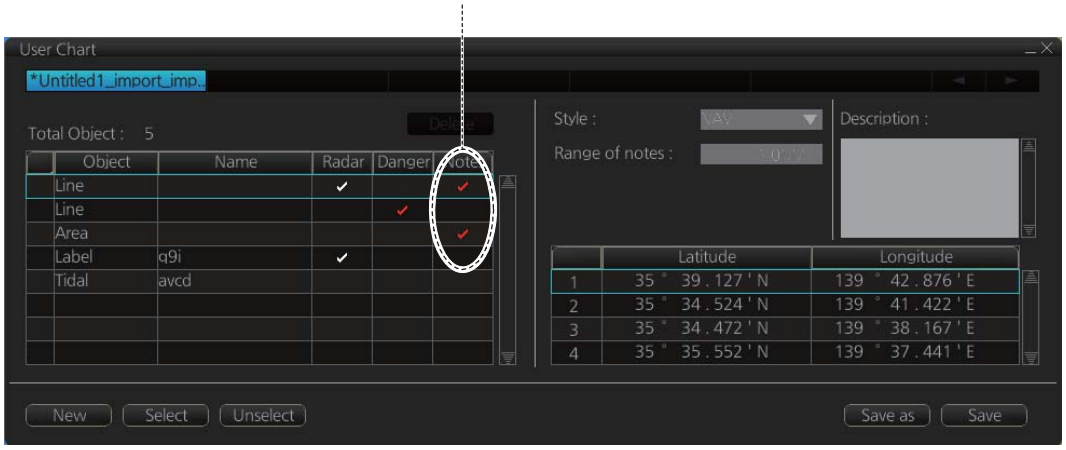
- Conditions for chart alerts during route monitoring, which includes safety contour and other chart alerts, on the [Alert Parameters] page of the [Route Plan] dialog box.

- Name of the user chart to be used during route monitoring together with this planned route, on the [User Chart] page of the [Route Plan] dialog box.



- Name of the Notes to be used during route monitoring together with this planned route, on the [User Chart] dialog box.

Check in Notes column indicates Notes is used with route monitoring and planned route



Recalculate timetable and ETA values

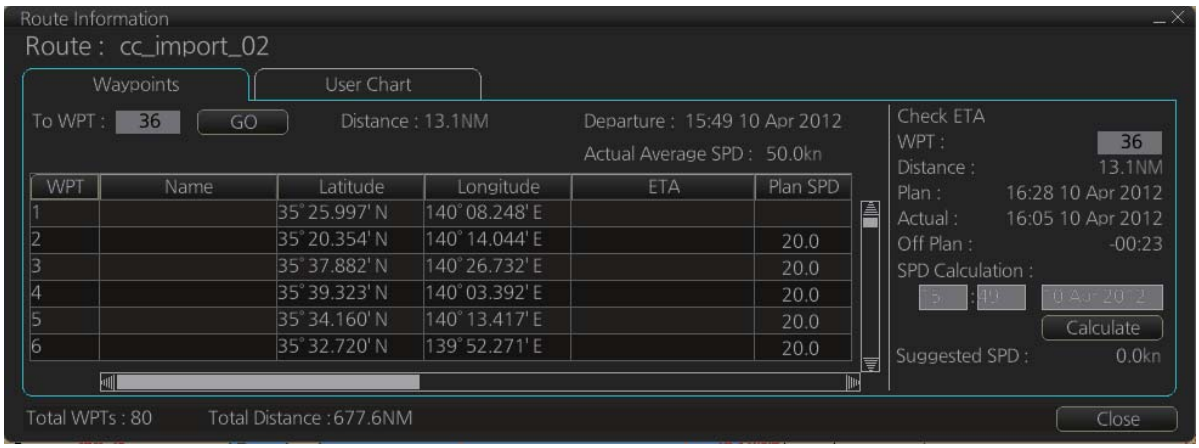
Timetable and ETA values can be recalculated from the [Optimize] page in the [Route Plan] dialog box. Minimally set ETD to equal departure time, and set optimization values.

6.13.3 How to check and prepare route to monitor

Select a route for the voyage: In the Voyage navigation mode, click the [Route] button followed by the [Select] button, or right-click the route indication in the [Route Information] box (right edge of screen) then select [Select Route]. See chapter 12.

Note: A route cannot be opened if its planned settings are different from its navigation settings. The reason is given on the [Select Route] dialog box. In this case, open the route in the Voyage planning mode and click the [Check Route] button, on the [Alert Parameters] page. Adjust the route as necessary.

The To WPT can be selected, however WPT 01 cannot be selected.

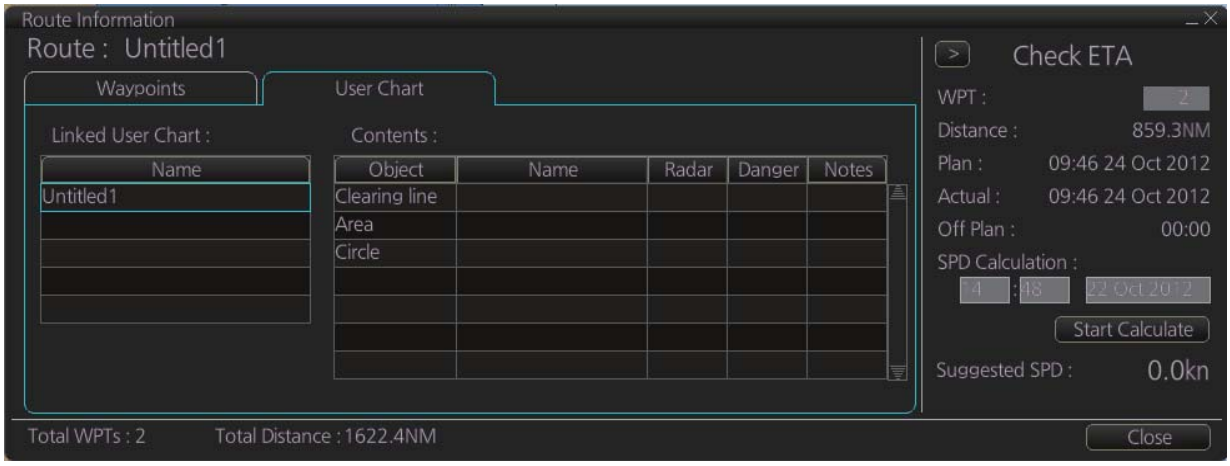


Select confirm conditions of the route plan

Check the setting on the [Chart Alert] dialog box; click the [DISP], [SET] and [Chart Alert] buttons to show that dialog box.

Planned user chart, Notes

To check what planned user chart is selected, open the [Route Information] dialog box and click the [User Chart] tab. The name of the user chart(s) to be used is in the [Linked User Chart] window.

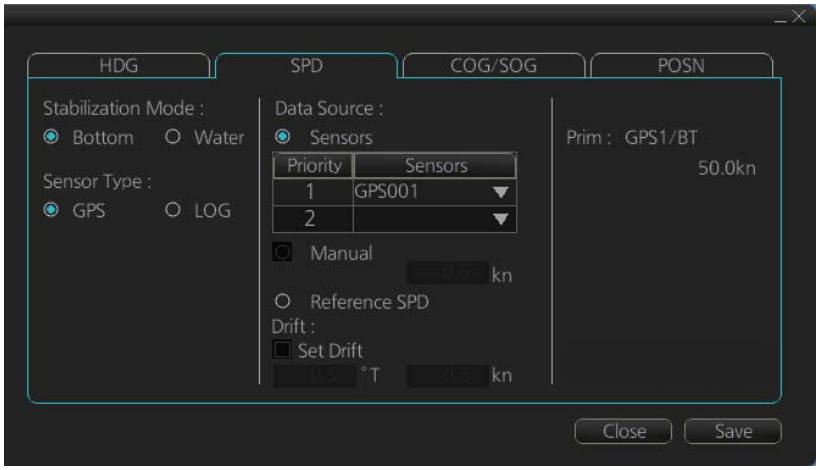


6.13.4 Check configuration of navigation sensors

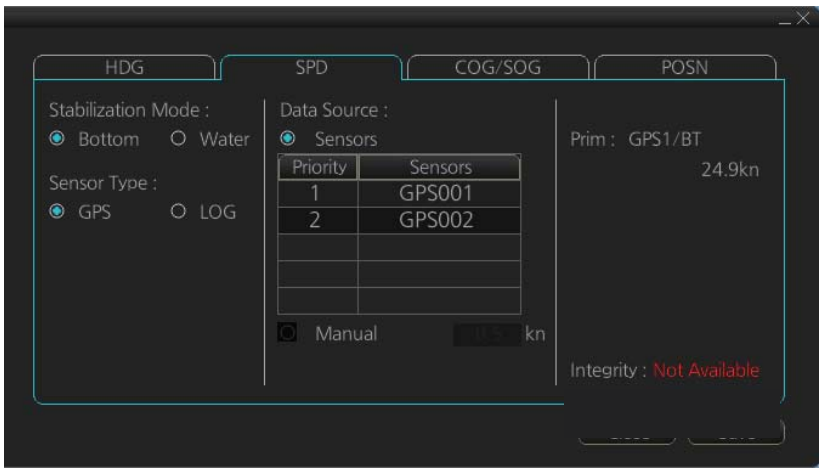
You can check the configuration of your navigation sensors in the [System Sensor Settings] page and [Local System Settings] page in the [General] menu.

Check speed settings ([SPD] page)

Open the menu and click the [SPD] tab in the [System Sensor Settings] page or [Local System Settings] page. The user can select navigation sensors for use in navigation and view their current values.



SPD page, local sensor



SPD page, system sensor

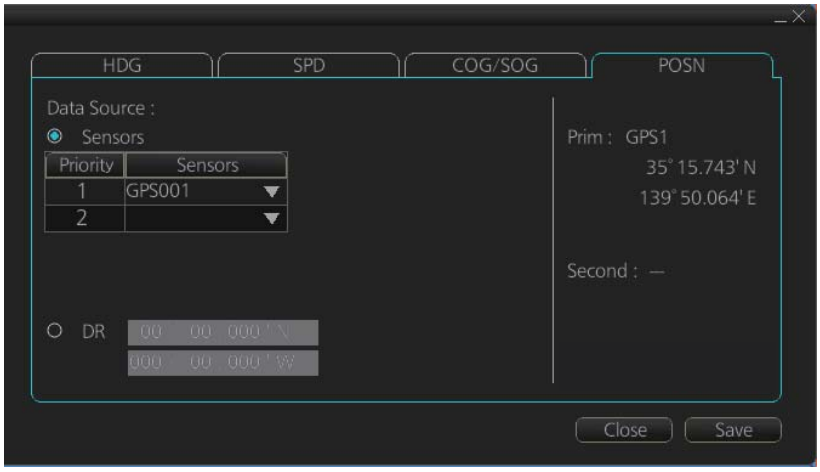
Checkbox status shows whether the sensor is used for integrated navigation or not. If there is no value shown for a sensor, it indicates that the sensor is not valid. Note that the content of these pages depends on the sensors that are in use on the ship.

Select the available dual logs.

Note that manual speed should only be used in an emergency, when no other speed reference is available. Remember that position sensors are also available as speed sources. If no dual log is available, check [Reference SPD] (local sensor page) to use a reference target from the radar as the source for speed and course.

Check position sensors (POSN page)

Open the menu and click the [POSN] tab in the [System Sensor Settings] page or [Local System Settings] page. The [Prim] and [Second] labels indicate the type of the position sensor. (In the figure below the [Prim] label shows GPS1). [Prim] and [Second] indicate sensor status and priority.



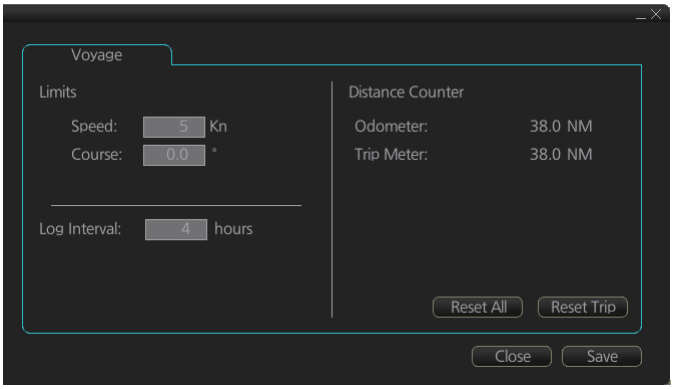
Only one sensor can be primary while the others can be secondary or off position. After a sensor is turned off, its status is changed to Secondary state. When a position sensor state is changed to primary and another sensor was primary, the sensor formerly primary becomes secondary.

Select the "Primary" navigation sensor as the sensor that is considered to be most accurate and reliable. Set all other navigation sensors as "Secondary".

6.13.5 How to reset odometer and trip meter

To reset the odometer and/or trip meter do as follows:

1. Open the menu and select the [Voyage] menu from the [NAVI Log] menu.



2. Click one of the following buttons as appropriate.
   Reset Trip: Reset the trip distance.
   Reset All: Reset both the odometer and the trip meter.
3. Click the [Close] button to finish.

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7. HOW TO MANAGE CHARTS

This chapter mainly shows you how to Install licenses, public keys and charts, and update charts. All chart-related operations begin from the Chart maintenance mode, which you access by clicking the [CHARTS] button on the Status bar.

Note 1: Chart and routes can be shared with other FMD-3xx0 units and FCR-2xx9, via LAN. Data is shared automatically; no operation is required.

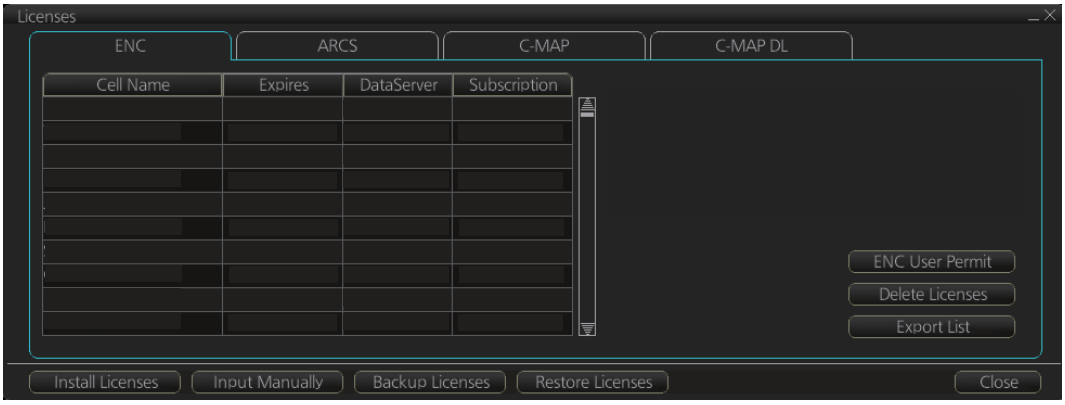
Note 2: Chart processing (installation, deletion, etc.) may take several minutes depending on the number of charts to be processed.

7.1 How to Install Licenses

Follow the procedure below to install your license(s). Be sure to install all of your licenses.

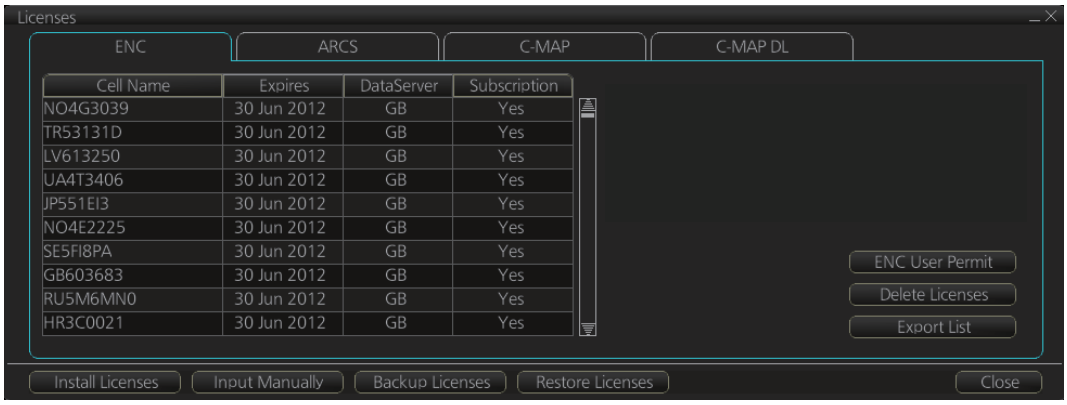
7.1.1 Automatic installation of license

1. Insert the media that contains your license.
2. Get into the Chart maintenance mode then click the [License] button on the InstantAccess bar to show the [Licenses] dialog box.

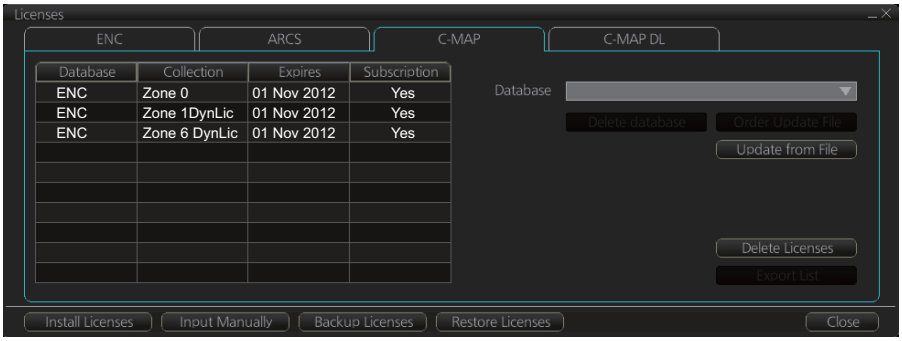


3. Click the [Install Licenses] button.

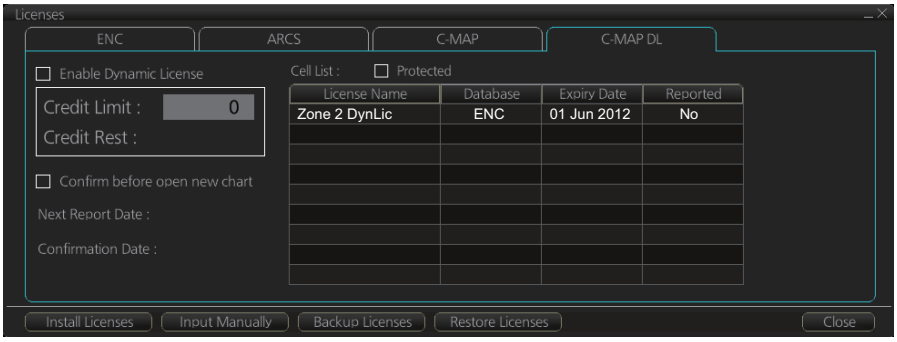
4. Find the folder on the media that contains the license to be installed.
5. Click the [OK] button to load the license. The [License] dialog box shows information about the license according to the license type.
   ENC: Cell name, date of expiration, data server name and subscription type. [Yes] appears if license exists; [No] if no license.



C-MAP: Database name, collection name, date of expiration and subscription type. [Yes] appears if license exists; [No] if no license exists. The [C-MAP Setup] button initializes the C-Map E-token. Click the button followed by the [OK] button to do the initialization. "CMAP: No connection to eToken" disappears from the Permanent warning box after completion of the initialization.



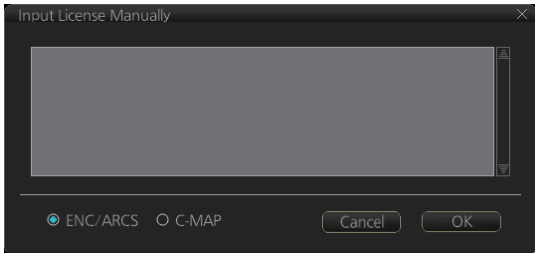
C-MAP DL: License name, database name, expiry date and reported status (Yes or No).



6. Click the [Close] button to finish.

7.1.2 Manual installation of license

There may be a case where you do not have the media where your ENC licenses are stored. In this case you can enter the license no. manually. Click the [CHARTS] button on the Status bar to go the Chart maintenance mode. Click the [Licenses] button. Click the [Input Manually] button to show the [Input License Manually] box. Select the type of license, ENC/ARCS or C-MAP. Enter the license number(s) then click the [OK] button.



7.1.3 How to backup, restore licenses

You can make backup copies of your licenses and store them on a USB flash memory.

To backup licenses, click the [License] button in the Chart maintenance mode to show the [Licenses] dialog box. Click the [Backup Licenses] button, select where to save the licenses then click the [OK] button.
To restore licenses, show the [Licenses] dialog box. Click the [Restore Licenses] button, select the licenses to restore then click the [OK] button.

7.1.4 How to display ENC permit

1. Get into the Chart maintenance mode then click the [License] button.
2. Click the [ENC] tab.
3. Click the [ENC User Permit] button.
4. Click the [OK] button to finish.

7.1.5 How to export the ENC license list

You can export a list of your ENC licenses to a USB flash memory, in .txt format.

1. Set a USB flash memory in the USB port on the Control Unit.
2. Get into the Chart maintenance mode then click the [License] button.
3. Click the [ENC] tab.
4. Click the [Export List] button.
5. Select where to save the file.
6. Change the file name at [File Name] if desired.
7. Click the [Save] button.
8. Click the [OK] button to finish.

7.2 How to Install Public Keys for S57 Charts

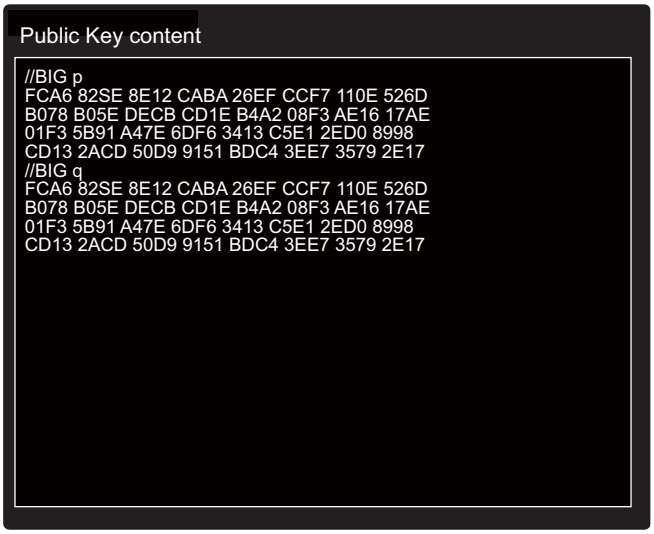
The procedure below shows how to install a public key. Public keys are used with ENC charts that support S-63 authorization. Public keys are not pre-installed. Before you install a new chart, confirm that the corresponding public key is installed.

Generally, there are two types of public keys:

- RENC: For example, Primar (file name: PRIMAR.PUB)
- JHA (file name: IHO.PUB)

1. Insert the media that contains the public key.
2. Get into the Chart maintenance mode then click the [Public Key] button on the InstantAccess bar.

3. Click the [Load New Key] button to show the [Open File] dialog box.
4. Select the applicable .pub file from the [Open File] dialog box then click the [Open] button. The [Public Key] dialog box reappears.
5. Click the [Display Content] button in the [Public Key] dialog box to show the display contents.



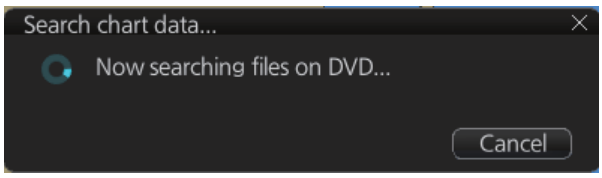
6. To accept the contents, click the [Activate] button.

7.3 How to Install Charts from a CD-ROM, Other Media

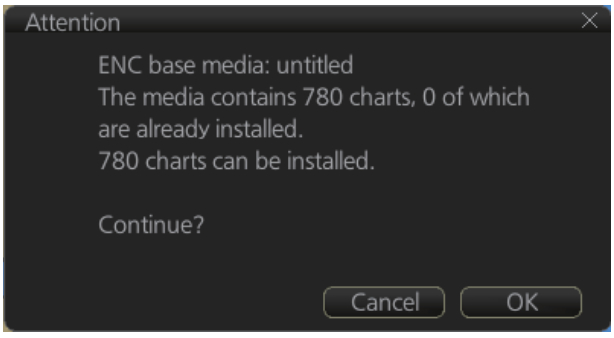
When you load charts from a CD ROM, the system first loads a catalog, which stores certain information into your SSD such as cell IDs, their position, and edition number, from the install media. Then, the system asks which charts you want to load from the chosen media. After building the catalog, you can view the contents of it by using by clicking the [Cell Status] button.

Note: When installing charts, do not cancel the installation while it is in progress. Cancellation will automatically reset the power, stopping the installation. If this occurs, try to install the charts again. If the charts still cannot be installed, reset the power and try again.

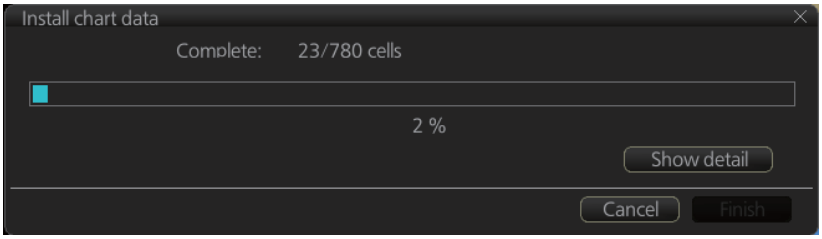
1. Set the media into its drive.
2. Get into the Chart maintenance mode then click the [AUTO Load] button on the InstantAccess bar. A prompt informs you that it may take a while to do the loading and are you sure to continue.
   Click the [OK] button. The following message appears.



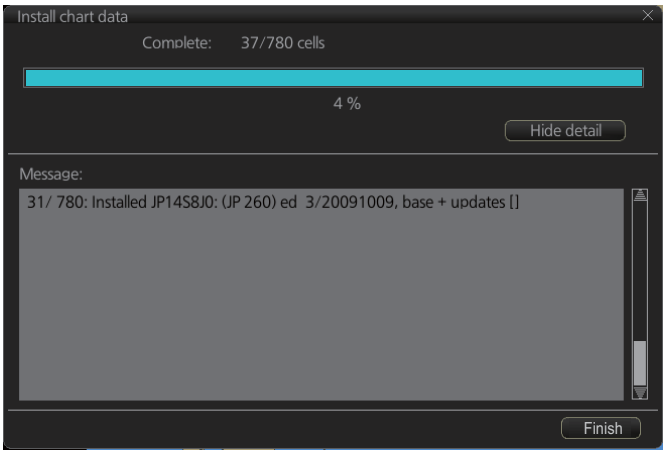
   When the system finds charts on the DVD drive it displays the results. The example below shows an example for ENC charts. To cancel the search, click the [Cancel] button.



3. Click the [OK] button. Loading then starts automatically. A status bar appears and shows the percentage of completion, with digital and analog indications.

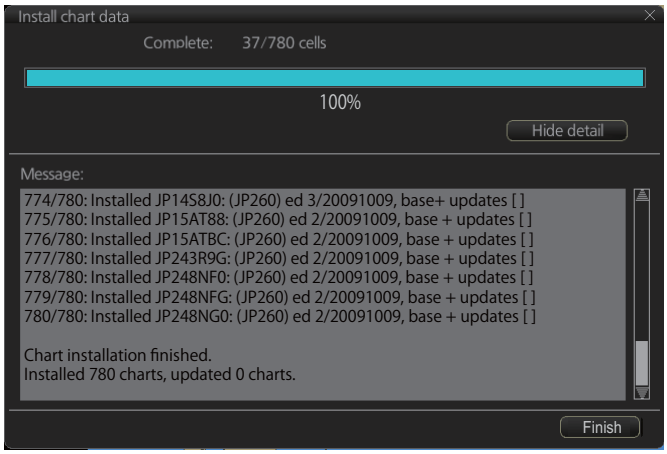


To show details during the loading, click the [Show detail] button.



To close the message, click the [Hide detail] button.

4. When the loading is completed, information about the charts loaded appears in the [Message] window. Click the [Finish] button.



5. Insert the next sequential media.
6. Repeat steps 1-4 to load the chart.
7. After you have loaded all charts, insert the "Update CD ROM (or other media)."
8. Repeat loading procedure for Update CD ROM (or other media).

Note: When many charts are installed, the system checks for error in the installed data at the next power up. This is not an indication of malfunction.

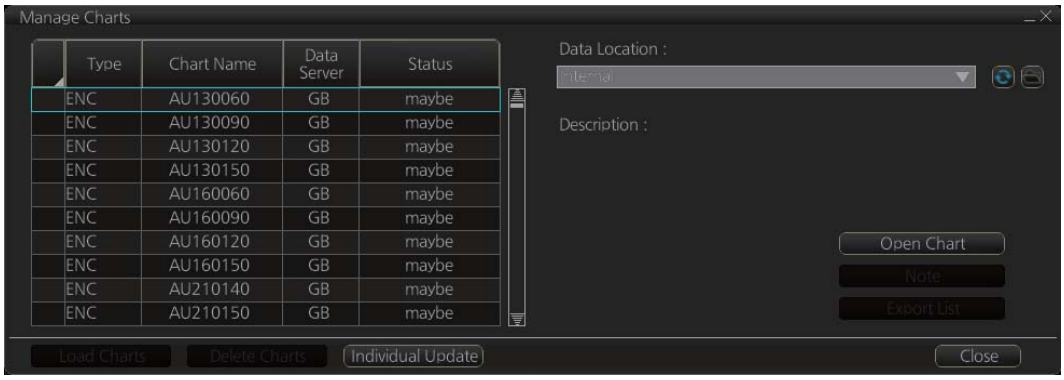
7.4 Manual Installation of S57 Charts that are not Fully Compliant with IMO Standards

The chart radar can, in some cases, load S57 charts that do not have full compliance with S57 standard coding for transfer media. Minimum requirements for loading manually is legally coded:

- XXXXXXXX.000 file, which includes a Base cell.
- XXXXXXXX.NNN file, in which NNN is a number from 001 to 999, and which includes an update.

To load charts without building a named "CD-ROM catalog" do the following:

1. Get into the Chart maintenance mode then click the [Manage Charts] button to show the [Manage Charts] dialog box.



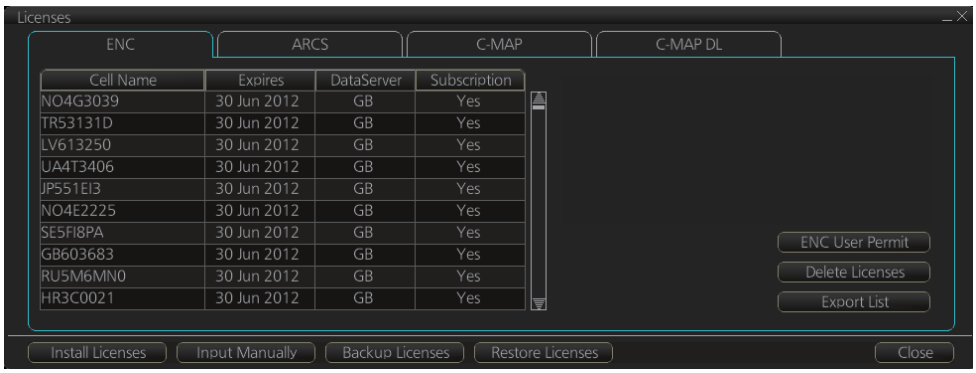
2. Click the icon to the right of the [Data Location] pull-down menu to select drive.
3. Click the [Load Charts] button.

7.5 How to View Permit Status

Permits are used to control the right to use a chart in the chart radar. A permit is connected to the edition of a chart. Permits are issued in two different types:

- **Subscription permit**: This type of permit includes updates for subsequent 3, 6, 9 or 12 months.
- **One-Off permit**: This type of permit includes only updates up to the issue date of the permit.

The expiry date of a permit controls the loading of Base charts and their updates to the chart. The system will warn you when you are loading charts or updates that are issued less than 30 days before the expiration date of a permit. If a permit has expired, it is impossible to load a chart or its update that was issued after the expiration date of the permit. The user has a right to view a chart forever, except C-MAP charts that have viewing periods which end two months after the expiry date of the license. If the charts are not updated regularly it will not complete the requirements for having up-to-date charts. To view the permit status of a chart, click the [License] button on the InstantAccess bar and then click applicable "chart" tab, among ENC, C-MAP and C-MAP DL. The example below shows the status of ENC charts.



The expiration date of each cell appears in the [Expires] window and subscription status is indicated in the [Subscription] window, as [Yes] or [No].

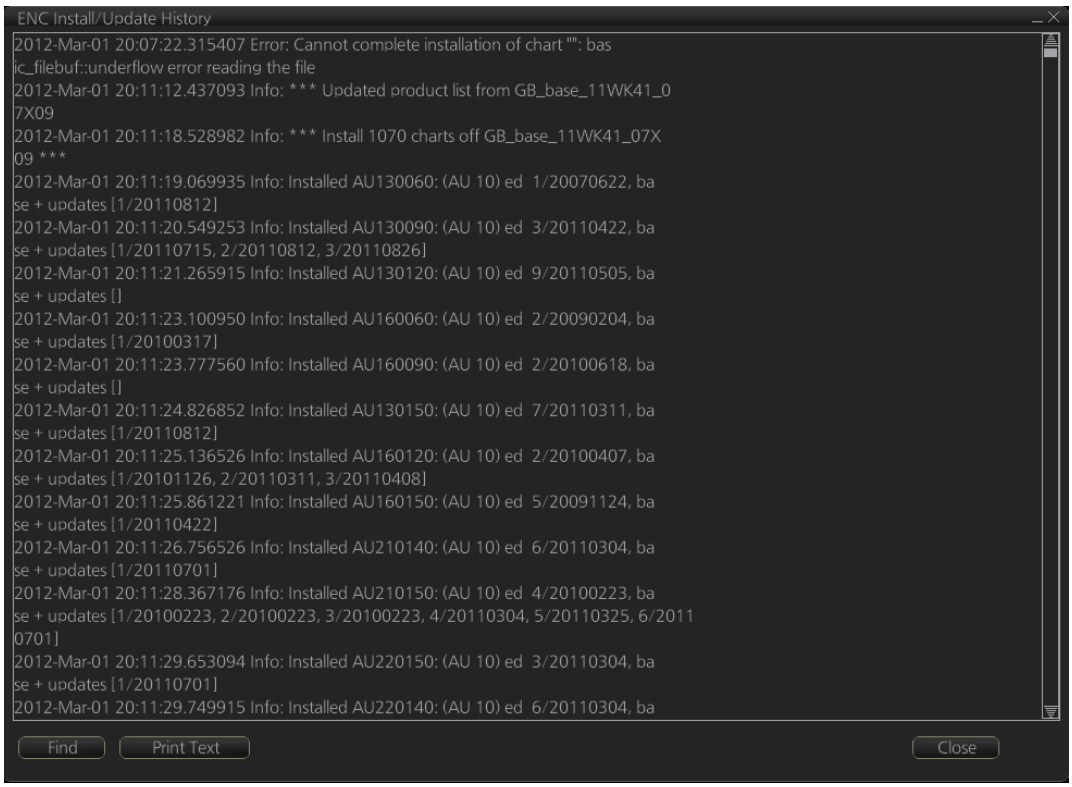
Subscription warnings for RENC

If you have at least one subscription-type permit, the system will automatically warn you about the expiration date of your subscription license, in the Permanent warning box.

Note: If you change service provider for some reason, it is recommended that you remove all the charts from the chart radar before loading new charts of new service provider.

7.6 How to Display Install/Update History

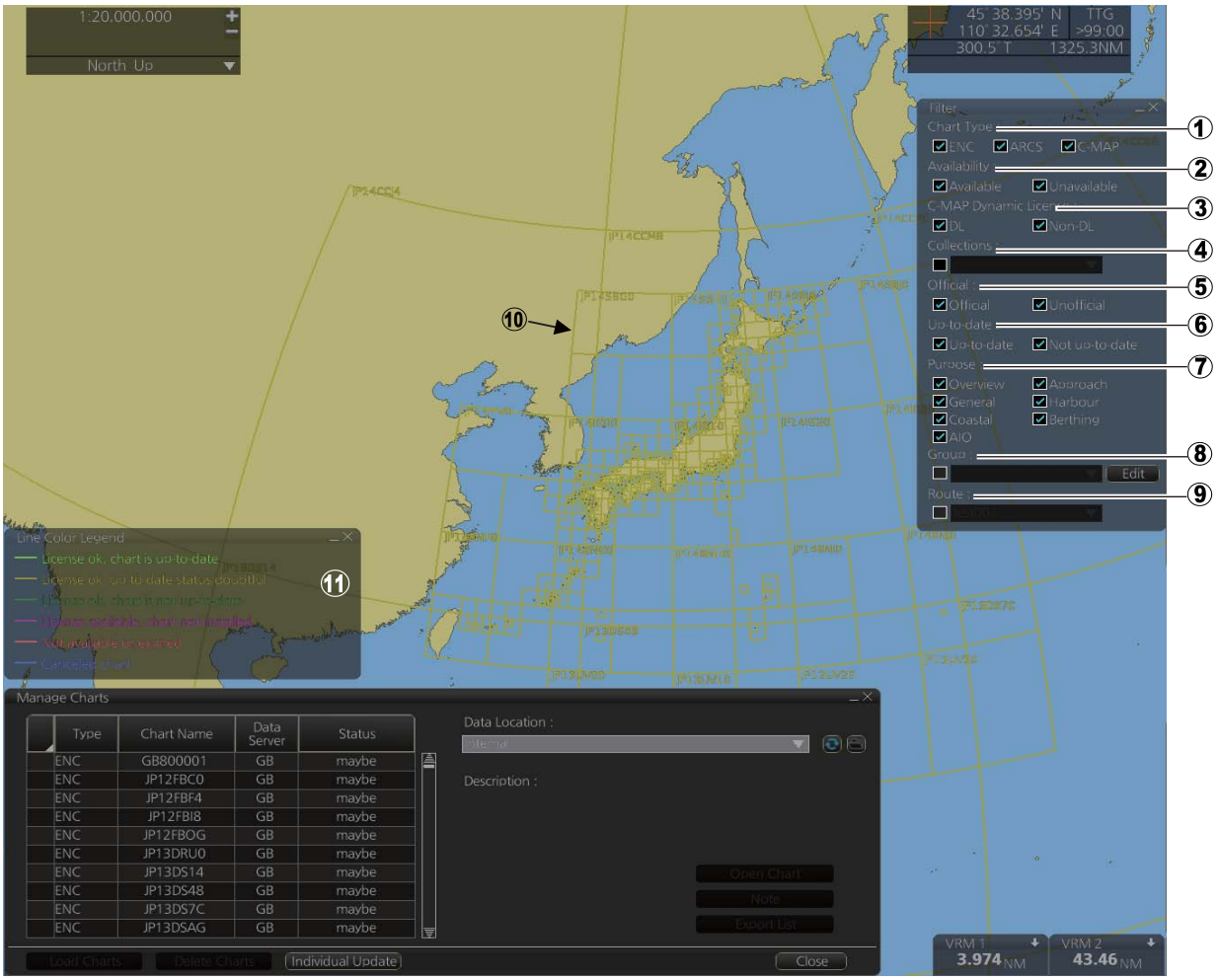
You can view what is loaded from a CD-ROM or other media. Click the [Record], [Chart Log] and [ENC] or [C-MAP] buttons on the InstantAccess bar. The example below shows the install/update history for ENC charts.



7.7 Catalog of Chart Cells

A catalog is used to view graphical coverage of the charts stored in your SSD, available in a named "CD ROM," or other media. Available charts are displayed using their limits of charts. Note that sometimes the real coverage of the charts may be considerably less than the declared limits of it. You can cursor-pick any chart by going over its limit then you can view the information for it.

To display the catalog, get into the Chart maintenance mode then click the [Manage Charts] button on the InstantAccess bar. The [Filter] window lets you choose what to display. Check or uncheck items as appropriate.



1) Chart Type
   ENC: Display ENC charts.
   C-MAP: Display C-MAP charts.
2) Availability
   Display available or unavailable charts.
3) C-MAP Dynamic License
   Display DL or non-DL C-MAP charts.
4) Collections
   A collection is a pre-defined dataset, the contents of which can be defined by zone, individual chart or any of those combinations. Applicable to C-MAP charts also.
5) Official
   Display official or unofficial charts.

6) Up-to-date
Display charts which are or are not up to date.

7) Purpose
Display chart according to its purpose - Overview, General, Coastal, AIO, Approach, Harbor, Berthing.

8) Group
See the next section for how to group charts.

9) Route
Show or hide chart area with route.

10) Chart boundary boxes
Define the area covered by a chart and are color-coded according license and permit status.

11) Line color legend
The line color legend provides information about license validity.

Color	Static license/permit	Dynamic license
Green	License is valid, chart is up-to-date.	Reported
Orange	License is valid, chart is NOT up-to-date.	Not applicable
Magenta	License available, chart not installed.	Unissued or expired
Yellow	License is valid, up-to-date status doubtful	Issued, not reported
Red	License not available or has expired.	Reporting date expired.
Blue	Cancelled chart	Opening disabled by user.

7.7.1 How to group chart cells

You can define groups of like-format chart cells. This means you can collect related charts, for example, all cells that cover a route from Liverpool to New York or all cells available from a National Hydrographic Office.

You can make a group and define charts from the [Edit Group] dialog box.

How to make a new group of chart cells

1. In the Chart maintenance mode, click the [Manage Charts] button on the InstantAccess bar.
2. Click the [Edit] button in the [Filter] window to show the [Edit Group] dialog box.

3. Click the [New] button.
4. In the [Outside Group] window, click the box to the left of the chart cell you want to add to the group to show a checkmark. (A context-sensitive menu with "Select all" and "Deselect all" functions is available by right-clicking the box to the left of [Name], in either window.)
5. After you have selected the cells to add to the group, click the << button to move the names of the selected cells to the [Inside Group] window. If you want to remove a chart from the group, select it then click the >> button.
6. Click the [Save] button.
7. Enter a name for the group, using the keyboard on the Control Unit or the software keyboard, then click the [OK] button.
8. Click the [Close] button to finish.

How to edit a group of chart cells

You can edit a group of chart cells from a group as follows:

1. In the Chart maintenance mode, click the [Manage Charts] button on the InstantAccess bar to show the [Filter] window.
2. Click the [Edit] button.
3. At the item [Group name], elect the name of the group with the pull-down list.
4. In the [Inside Group] window, click the box to the left of the chart cell you want to remove from the group to show a checkmark. (A context-sensitive menu with "Select all" and "Deselect all" functions is available by right-clicking the box to the left of [Name].)
5. After you have selected the charts to remove to the group, click the >> button to remove the selected charts cells from the group.
6. Click the [Save] button to finish.

How to delete a group of chart cells

You can delete group of chart cells as follows:

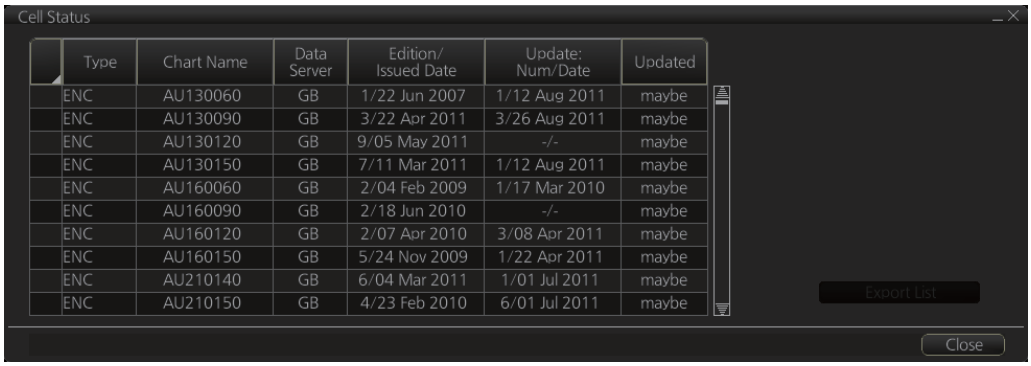
1. In the Chart maintenance mode, click the [Manage Charts] button on the InstantAccess bar to show the [Filter] window.
2. Click the [Edit] button.
3. Select the name of the group with the pull-down list at the item [Group name].
4. Click the [Remove] button.
5. Click the [Close] button.

How to select the group to view

In the Chart maintenance mode, click the [Manage Charts] button on the InstantAccess bar to show the [Filter] window. Select the group to view from the pull-down list at [Group].

7.7.2 How to view status of chart cells

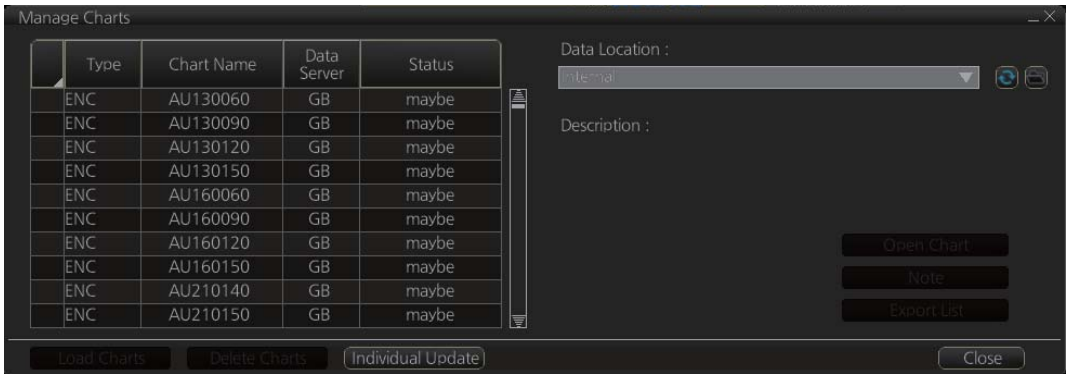
The [Cell Status] dialog box shows the status of the chart cells stored in the system. To show this dialog box, get into the Chart maintenance mode then click the [Cell Status] button on the InstantAccess bar.



- **Type**: Type of chart cell, ENC or C-MAP.
- **Chart Name**: Chart name
- **Data Server**: The name of the data server where the chart was downloaded from.
- **Edition/Issued Date**: Edition no. and issued date of the chart cell.
- **Update: Num/Date**: No. and date of the update of the chart cell.
- **Updated**: "yes" is shown if the cell is up-to-date, "no" if the cell is not up-to-date, “maybe” means the cell has not been updated from more than one month.

7.8 How to Open Charts

In the Chart maintenance mode, click the [Manage Charts] button on the InstantAccess bar to display the dialog box shown below. Put a checkmark next to the chart(s) to open then click the [Open Chart] button.



Note: After opening several charts, reset the power to maintain performance.

7.9 How to Delete Charts

Click the [Manage Charts] button to show the [Manage Charts] dialog box. Click the block to the left of the chart to remove to show a checkmark. A context-sensitive menu with "Select all" and "Deselect all" functions is available by right-clicking the block to the left of "Type". Click the [Delete Charts] button to delete the selected charts.

7.10 How to Show Publishers Notes for S57 Charts

You should read the text file associated with each catalog, which you can view when loading a chart from a CD. Click the [Note] button in the [Manage Charts] dialog box. You can print a hard copy with the [Print Text] button.

F1(FINLAND)
According to the SOLA convention (IMO Marine Safety Committee Resolution 99(73), which came into force July 1st 2002, this official Electronic Navigational Chart (ENC) produced by the Finnish Maritime Administration (FMA) can be used as a primary chart when there are no larger scale chart data available and the mariner is using a type approved chart system.

This ENCS is based on paper charts and is published by the FMA. There are several ENCs available for the Finnish coast. For the latest ENC coverage of Finnish water, please contact your local ENC distributor.

7.11 How to Export a List of Charts

Click the [Export List] button in the [Manage Charts] dialog box to export a list of charts stored in the system to a USB flash memory, in .txt format.

7.12 How to Find the Chart Type

The electronic chart system can display more than one S57 chart cell at a time. This feature is called multi-cell display. If one S57 chart cell does not cover the whole display, the system opens more S57 chart cells for display, if appropriate cells for the displayed area are available. The Own ship functions box shows information about S57 chart cells displayed on the electronic chart display area. When automatic TM reset is active, the information is displayed with reference to your ship's position. If TM reset is OFF, the information is displayed with reference to current cursor position.

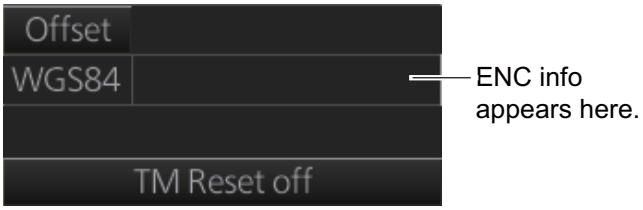


Chart type indication
No indication (Official ENC chart)
“Non-ENC data” (Unofficial ENC chart, indication in yellow)
“ENC data available” (Currently, RNC chart is in use, but ENC material is available. Indication shown in yellow.)

7.13 How to Update Charts Manually

Manual update may include deleting an already existing object, modifying a position or other characteristics of an already existing object or inserting of a new object. In this system, manual updates are stored in a common database.

Mariners cannot permanently remove any of the official objects from the chart display. If a mariner needs to make obsolete any of the official objects he deletes them. Then, in practice, the deleted features are still visible, but they are displayed a certain way to indicate a deleted object.

However, a mariner can remove objects that he has inserted himself.

Note that the manual updates have no automatic connection to any automatic update received later for charts. If a manual update itself became obsolete, because the official chart has been updated to include the update defined as a manual update, the mariner must himself delete the obsolete manual update in question.

The system records complete usage of manual updates. All deletions, modifications and insertions are recorded and time stamped. If the mariner wishes to see what kind of manual updates he had in the past, for example, two weeks ago, he uses Update History to specify the relevant date range. For information on how to set Display date and Approved until dates on S57 charts, see section 9.3.3.

Note 1: If the equipment automatically restarts when manually updating an ENC chart, try the manual update again after the equipment finishes restarting. If you still cannot do the manual update, reset the power then try again.

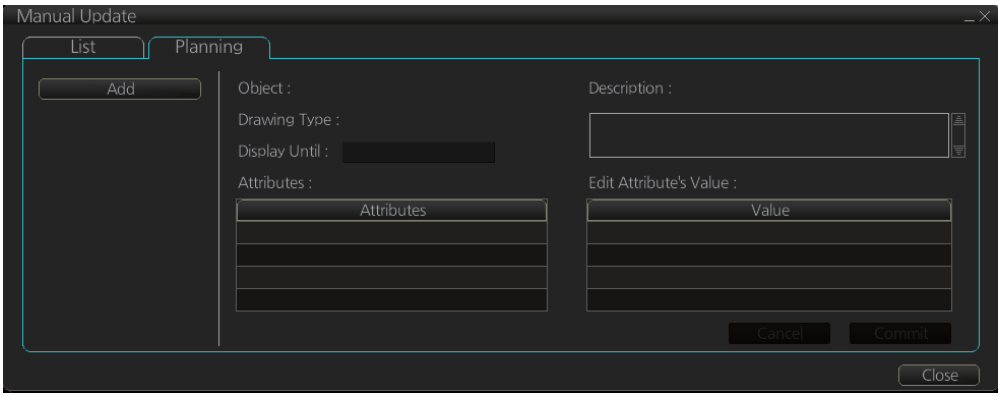
Note 2:

7.13.1 How to insert update symbols

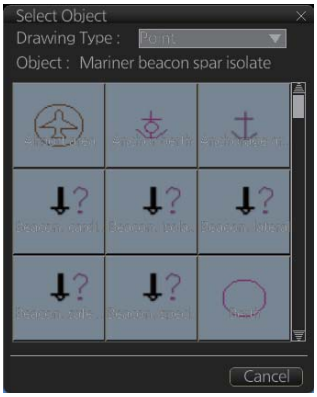
An update symbol can be added as shown in the procedure below.

Note: An update symbol that straddles the international date line cannot be edited. In-this case, insert the same symbol on each side of the line.

1. Go to the Voyage navigation mode.
2. Click the [Manual Update] button on the InstantAccess bar to open the [Manual Update] dialog box.
3. Click the [Planning] tab.



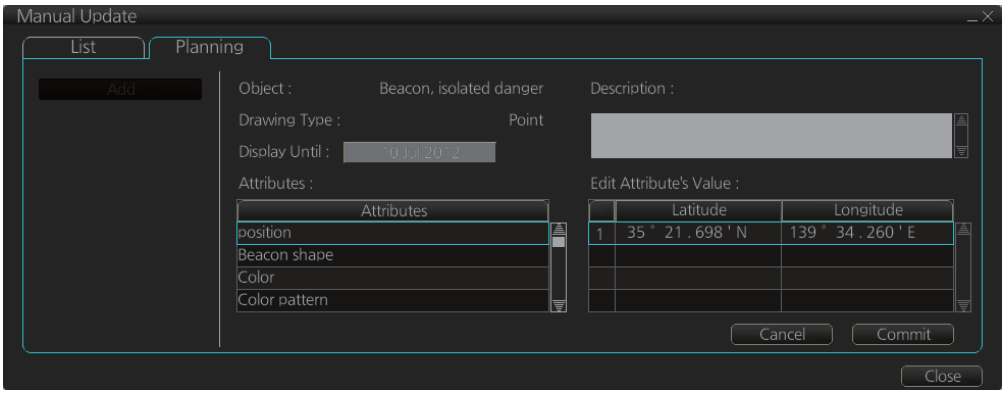
4. Click the [Add] button.



Note: The above window can also be shown from the context-sensitive menu. Right-click the display area then select [Manual Update] and [Add New].

5. Use the [Drawing Type] pull-down list to select drawing type: point, line or area.
6. Click desired object.

7. Put the cursor on the location where to insert the symbol then left click. The [Manual Update] dialog box shows:
   - Object
   - Drawing type
   - Display until date



8. You can add a comment related to a manual update object in the [Description] box.
9. To add textual information to an attribute, select the attribute from the [Attributes] window then add text in the [Edit Attribute's Value] window.
10. Click the [Commit] button to add all selected objects to the chart.

7.13.2 How to delete update symbols

Manually entered update symbols cannot be deleted until the "Display Until" date arrives or is changed. However, you can mark the symbol to indicate that it can be ignored.

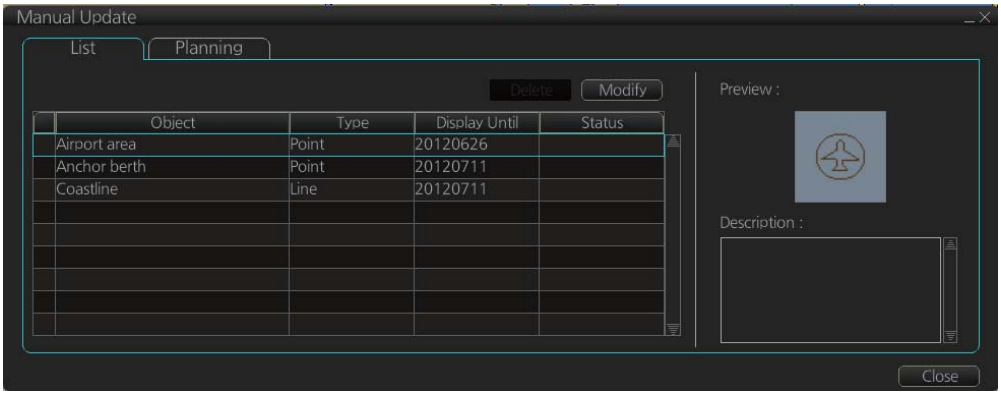
1. Put the cursor on the symbol then right-click to show the context-sensitive menu.
2. Select [Manual Update] and [Delete].

Note: A symbol can also be deleted from the [Manual Update] dialog box. Follow steps 1 and 2 in section 7.13.1, click the [List] tab, select the symbol to delete then click the [Delete] button.

7.13.3 How to modify existing update symbols

The position, Display Until date and description of an update symbol can be modified. A symbol that is marked as “deleted” cannot be modified.

1. Follow steps 1-2 in section 7.13.1 to display the [Manual Update] dialog box.
2. Click the [List] tab.



3. Select the object to modify then click the [Modify] button, and the [Planning] dialog box appears.
4. Modify the object referring to steps 8 and 9 in section 7.13.1.
5. Click the [Commit] button.

8. HOW TO CONTROL CHART OBJECTS

This chapter provides the information necessary for controlling chart features.

8.1 How to Browse Your Charts

You can view your charts using different positions and different scales. The basic tools for browsing charts are the **RANGE** key, chart offcenter, and scroll.

RANGE - RANGE + and change the chart scale. (The scrollwheel also can change the chart scale. Spin to change.) If true motion reset is active, ZOOM IN and ZOOM OUT keep the relative position of your ship with respect to the display. If true motion reset is off, ZOOM IN and ZOOM OUT keep the relative position pointed by the cursor with respect to the display. The system automatically chooses next larger or smaller scale. If a chart with larger compilation scale is available at your current viewing position, the message "Larger Scale Data Exists" appears

To relocate own ship position on the screen, put the cursor where desired on the chart, right-click and select [Ship off center]. To return own ship position to the screen center, right-click anywhere on the chart and select [Ship on center].

To scroll your chart, simply drag and drop.

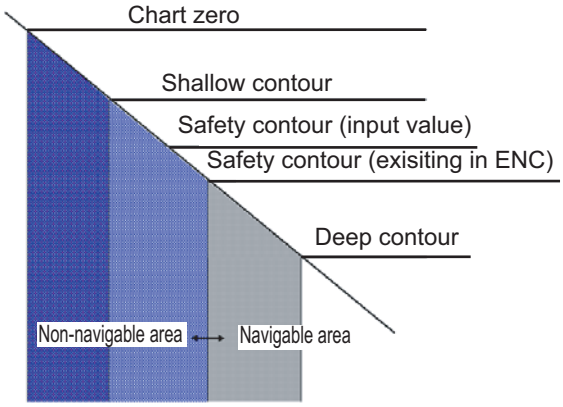
8.2 How to Control Visibility of Chart Objects

The [Chart Display] menu has several pages of chart features that you may show or hide as appropriate. To display this menu, click the [DISP], [SET] and [Chart DISP] buttons on the InstantAccess bar, or open the menu and select the [Chart Display] menu.

8.2.1 How to set value for shallow contour, safety depth, safety contour and deep contour

You can set values for Shallow Contour, Safety Depth, Safety Contour and Deep Contour, on the [Chart Alert] dialog box (sequence: [DISP], [SET], [Chart Alert]). Colors used for depth presentation on the electronic chart are controlled by setting values for Shallow Contour, Safety Depth, Safety Contour and Deep Contour. Soundings on the electronic chart, which are equal to or less than the value of Safety Depth, are highlighted. See the illustrations on the next page for multi-color presentation and two-color presentation. Selection of multi- and two-color presentations can be done by selecting from list box of "Depths" on the [Chart] page of [Basic Setting] menu.

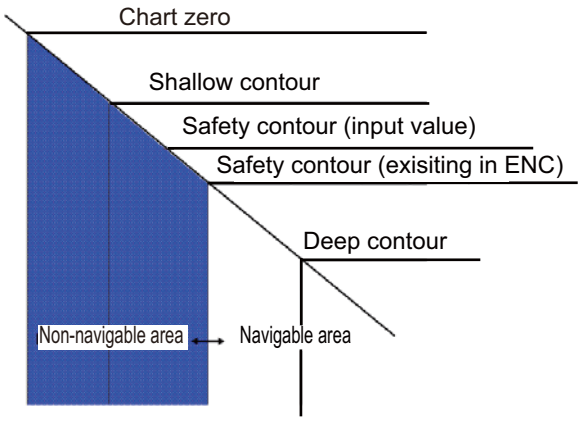
MULTI-COLOR presentation



In the multi-color presentation four colors are used for depths. If the value entered as the safety contour does not exist in the electronic chart, the system automatically selects the next available deeper depth contour as the safety contour. For example, the input value is 8 m, but there is no 8 m depth contour in the electronic chart. Then, the system automatically selects the next available deeper depth contour (10 m) as the safety contour. The depth contour value of 10 m is used as the safety contour in the electronic chart.

Shallow contour shows visual color change inside an unsafe water area. An unsafe water area is all areas shallower than the "safety contour". Set the value for the shallow contour less than the value of the safety contour.

TWO-COLOR presentation

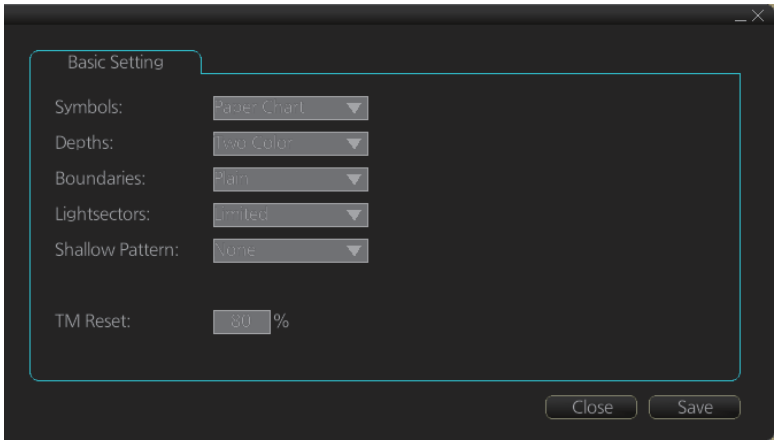


In the two-color presentation, unsafe water is shown in blue and safe water is shown in white. The safety contour is used to qualify unsafe water (depth shallower than safety contour) and safe water (depths deeper than safety contour).

If the value entered as the safety contour does not exist in the electronic chart, the system automatically selects the next deeper available depth contour as the safety contour, the same as with the multi-color presentation.

8.2.2 Basic Setting menu

To display this menu, click [DISP], [SET] and [Basic Setting] on the InstantAccess bar.



Symbols: Select how to display chart symbols. The options are

Simplified: The shape of symbols is of modern design and the sea mark symbols are filled in a color.

Paper Chart: The shape of symbols imitates traditional symbols used in paper charts.

Depths: Set how to display different depth zones on the chart display.

Two Color: he chart display uses only two colors:
- Deeper than safety contour
- Shallower than safety contour

Multi Color: The chart display uses four different colors for contours:
- Deeper than user-chosen deep contour
- Between deep contour and user-chosen safety contour
- Between safety contour and user-chosen shallow water contour
- Between shallow water contour and coastline.

Boundaries: Set how to display boundaries of some chart features. The options are:
Plain: The line styles are limited to plain solid and dashed lines.
Symbol: Some of the line styles use symbols to highlight the purpose of a line.

Lightsectors: Set how to display light sectors. The options are

Limited: The length of a light sector is fixed at 25 mm independently of the displayed scale.
Full: The length of a light sector represents its nominal range as defined by the chart producer.

Shallow Pattern: Set how to display shallow water area. The options are:

None: Shallow water areas are not shown.
Diamond: Provided to distinguish shallow water at night.

TM Reset: In the true motion mode, own ship moves until it reaches the true motion reset borderline (set here), and then it jumps back to an opposite position on screen based on its course. Set the limit for TM reset (in percentage). For example, "100" resets the position when the own ship marker reaches any edge of the display.

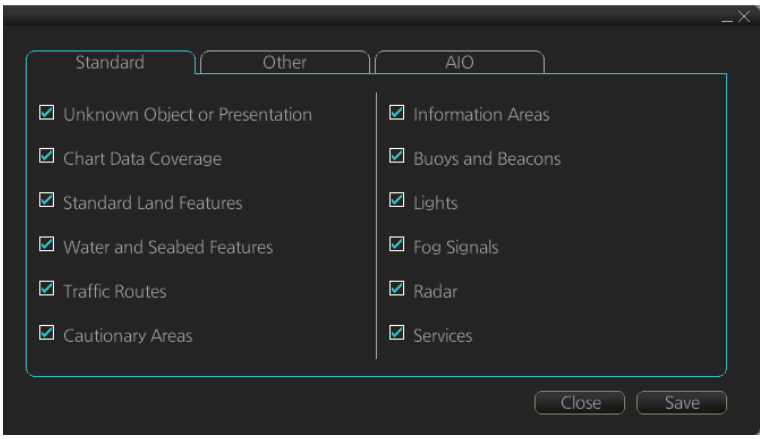
8.2.3 Chart Display menu

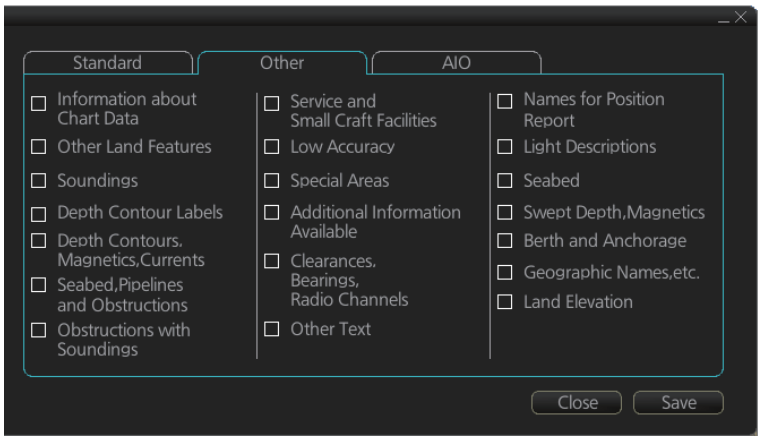
To access this menu and its pages, click [DISP], [SET] and [Chart DISP] on the InstantAccess bar then open the [Standard], [Other] or [AIO] page as appropriate.

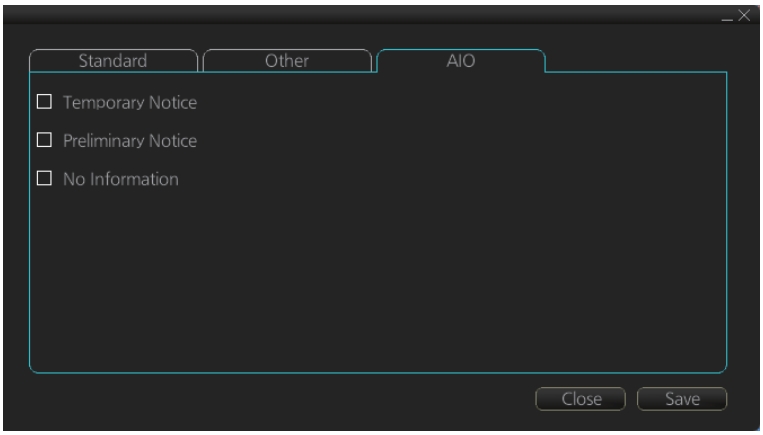
The [Standard] page contains chart features defined by IMO that comprise a standard display. You can recall the standard display at any time in a single action; click the [STD DISP] button on the Status bar to get the standard display.

The [Other] page contains chart features for which you can control visibility and that are not part of IMO-defined standard display.

The [AIO] page controls what to display on the Admiralty Information Overlay.







Note: To use the Info request feature, which provides information for cursor-chosen chart feature, the associated chart feature must be turned on from the [Standard] page.

8.2.4 Display base

A subset of chart features is called the “display base”. As required by IMO, these features cannot be made invisible. To get the display base, uncheck all items on the [Standard] and [Other] pages in the [Chart Display] menu.

The display base consists of the following chart features:

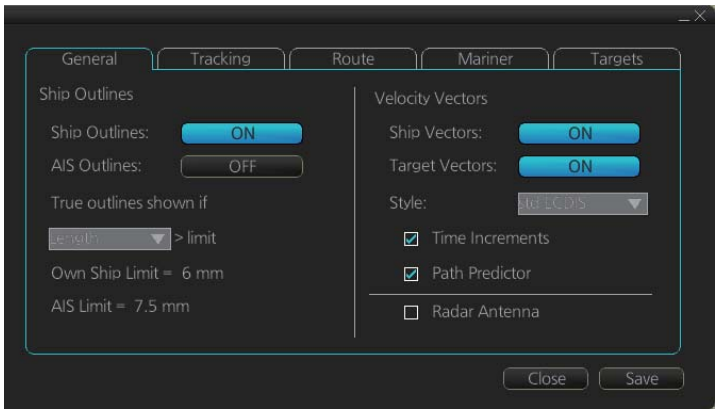
- Coastline (high water)
- Own ship's safety contour, which is chosen by the user
- Indication of isolated underwater dangers of depths less than the safety contour that lie within the safe waters defined by the safety contour
- Indication of isolated dangers that lie within the safe water defined by the safety contour such as bridges, overhead wires, etc., and including buoys and beacons whether or not these are being used as aids to navigation.
- Traffic routine systems
- Scale, range, orientation and operating mode
- Units of depth and height

8.3 How to Control Visibility of Symbols, Features

Control of symbols and features is divided into five pages in the [Symbol Display] menu, which you can access by clicking the [DISP], [SET] and [Symb DISP] buttons on the InstantAccess bar.
[General] page: Controls own ship and target related items.
[Tracking] page: Controls past tracks and some other features
[Route] page: Controls planned and monitored route.
[Mariner] page: Controls user charts
[Targets] page: Controls TT and AIS targets.

The user can define settings for chart details that are displayed over the chart area.

8.3.1 General page

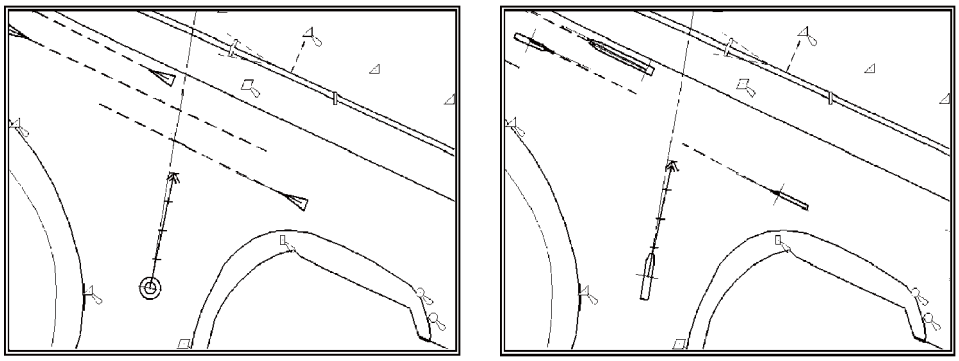


Ship Outlines

Ship Outlines: Select OFF or ON to show minimized or scaled symbol, respectively.
AIS Outlines: Select OFF or ON to show AIS targets in same size or scaled symbol, respectively.

True outlines shown if: If the length or width of the own ship mark is greater than 6 mm, the own ship mark is shown with the true scale symbol. Select [Length] or [Width].

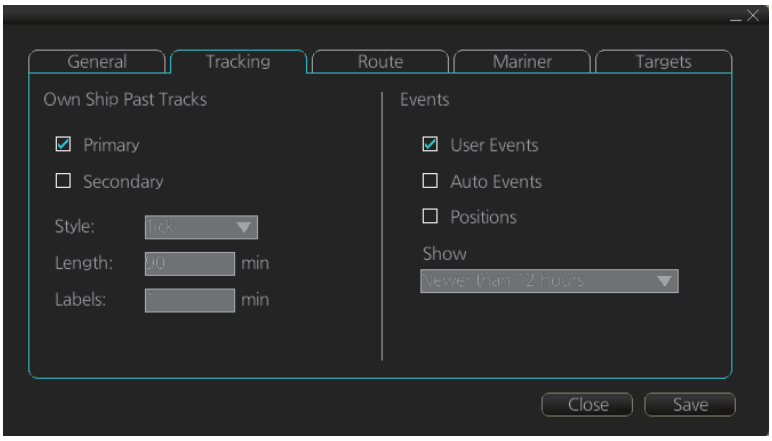
The right illustration in the figure below shows own ship mark and AIS targets with scaled symbols. The left illustrations shows own ship mark and AIS targets with point symbol. AIS targets are displayed as true scale symbol if the displayed chart scale is larger than set with "Outlines" limit (length>7.5 mm) on the [General] page in the [Symbol Display] menu and your own ship are displayed as true symbol scale if the size of the true scale symbol is larger than 6 mm on the chart display.



Velocity Vectors

Ship Vectors: Show or hide own ship vector.
Target Vectors: Show or hide target vectors.
Style: Select the vector style. The [std ECDIS] vector is a speed-referenced vector symbol. [Conventional] is a simplified symbol.
Time Increments: Check to show ticks of velocity vector. This controls both own ship and targets ticks. If ticks are too tightly spaced, they will be automatically removed from the display, until spacing between ticks is sufficient to distinguish them separately. This depends on display scale and speed of vessel and target.
Path Predictor: Check to show the path predictor. The path predictor is a single dashed line originating at the CCRP and drawn at a length to represent the distance and path own ship will travel over the ground in the user-selected time interval for own ship speed vector.
Radar Antenna: Check to mark position of radar antenna (with "x")

8.3.2 Tracking page



Own ship past tracks

Primary: Check to plot own ship's past track with position fed from the primary sensor.
Secondary: Check to plot own ship's past track with position fed from a secondary sensor.
Style: Select time stamp position for past track (indicated by Tick or Point)
Length: Select length of past track.
Labels: Select label interval.

Events

Events marks are based on the [Voyage] log records.

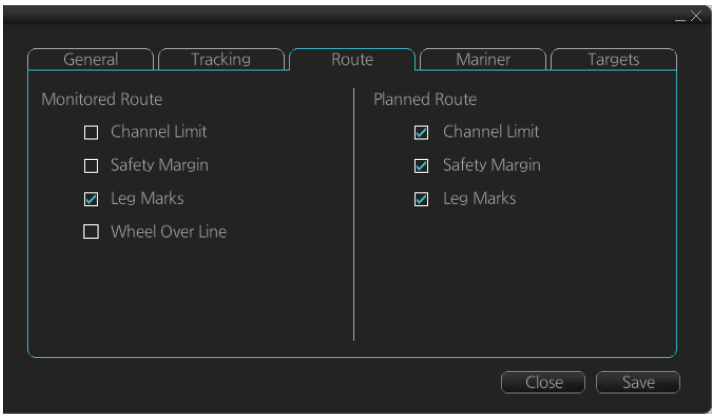
User Events: Display event symbols on the chart. User events are recorded by clicking [Record], [Event Log] and [User Event] on the InstantAccess bar.
Auto Events: Display automatically entered event symbols, where the system has recorded an event based on conditions you have set. Auto events are recorded every 1-4 hours.
Positions: Display the latitude and longitude of an event, recorded by clicking [Record], [Event Log] and [POSN Event] on the InstantAccess bar.

Note 1: A MOB event is visible always.

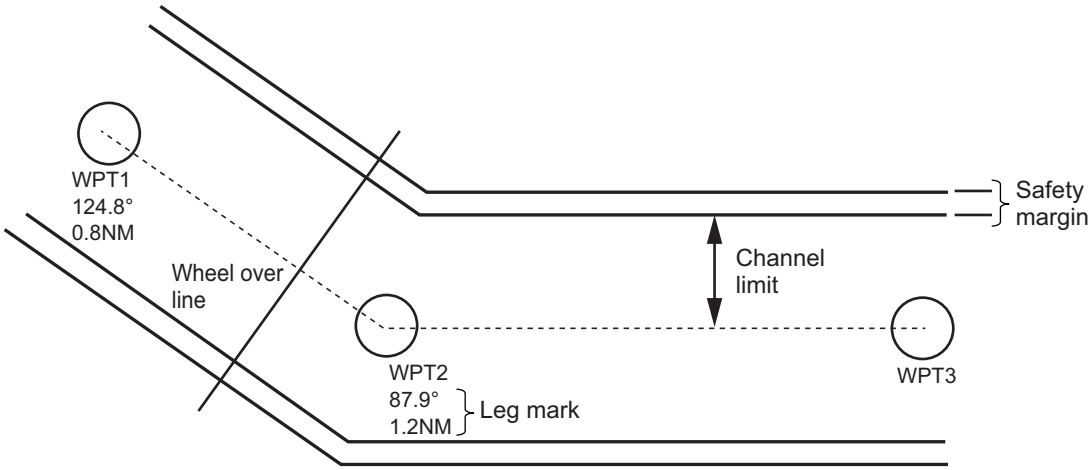
Note 2: You can choose the period of time to display event marks, from the [Show] list box. [Newer than 12 hours], [Newer than 24 hours], [Newer than 1 week], [Newer than 2 weeks], [Newer than 1 month], [Newer than 3 months], or [All].

8.3.3 Route page

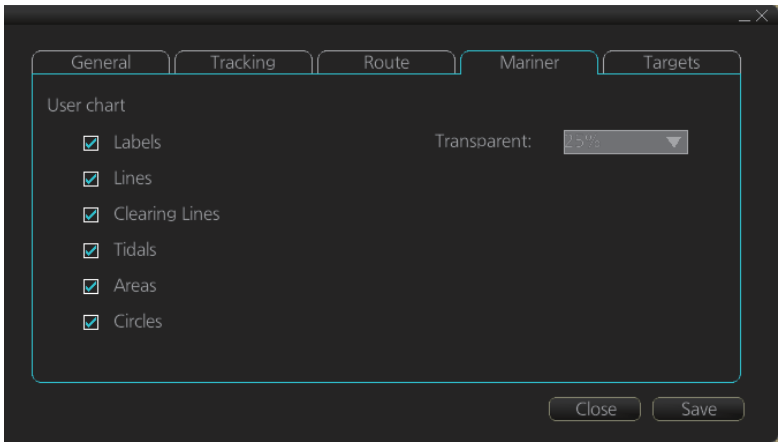
The [Route] page selects the route parts of the monitored and planned routes to show on the ECDIS.



Channel Limit: The distance from the centerline to one side of the nav lane.
Safety Margin: The distance from one side of the channel limit to the safety margin distance.
Leg Mark: Indications of waypoint no. and range and bearing to next waypoint.
Wheel Over Line: The location where the ship turns toward new course.



8.3.4 Mariner page

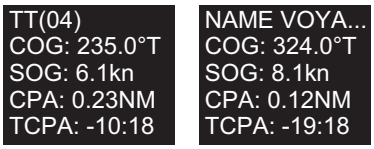


User chart

Labels: Check to show labels on user charts.
Lines: Check to show lines on user charts.
Clearing Lines: Check to show clearing lines (for marking dangerous areas) on user charts.
Tidals: Check to show symbols and tidals on user charts.
Areas: Check to show areas on the user charts.
Circles: Check to show circles on user charts.
Transparent: Set the degree of transparency for the user chart objects. Color fill for the areas can be chosen as transparent from 25% to 75% and as [No color fill]. If [No color fill] is chosen, only the boundaries of the areas are visible.

8.3.5 Targets page

Color: Select color of target (TT and AIS, common) from the list box.
TT Size: Select symbol size for tracked targets, Standard or Small.
AIS ROT TAG Limit: ROT (°/min.), limit to display AIS target with curved speed vector. (Source of ROT must be ROT gyro on target vessel.)
TT Label: Show or hide the TT label (target no.).
AIS Label: Show or hide the AIS label (ship's name).
TT Pop-up INFO: Show or hide the TT pop-up, which is shown by right-clicking a TT.
AIS Pop-up INFO: Show or hide the AIS pop-up, which is shown by right-clicking an AIS target.



TT pop-up info *AIS pop-up info*

Past position

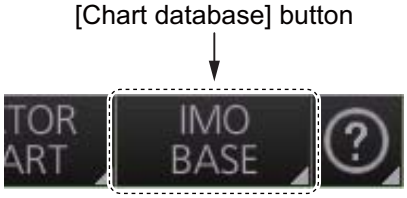
TT Points: Select the number of TT past position points to display.
AIS Points: Select the number of AIS past position points to display.
Style: Select style of presentation of target's past position.

8.4 Control of Predefined IMO Chart Display Settings

There are three sets of predefined chart display settings that can be used to display charts with certain chart features. The predefined chart display settings are

- IMO BASE
- IMO STD(STANDARD)
- IMO ALL

You can change the chart display setting in use with the [Chart database] button on the Status bar.



9. VECTOR (S57) CHARTS

Theoretically a chart can be coded for use on a computer as a vector chart. Vector-coded charts are coded using a variety of techniques. One technique is called S57ed3 and it has been chosen by IMO as the only alternative for SOLAS compliant electronic charts. If an S57ed3-coded chart is published by a government-authorized Hydrographic Office, then it is called "ENC". You can read more about ENC and related legal issues in this chapter. Hereafter, all references to vector chart material are referred to as "S57 charts" regardless of their source.

Sometimes you may wish to manually add Notices to Mariners or Navtex warnings into your S57 charts. This is called "manual updates". Also, manual updates are valid for all scales so that you don't need to repeat them for charts published in different scales from the same area.

9.1 Introduction to S57 Charts

An ENC chart is encrypted to prevent unauthorized use so the user needs a permit to view the ENC. This permit could be entered manually from the Control Unit, loaded from a USB flash memory.

Any new ENC must be loaded into the system. Some parts of the charts may be date dependent, i.e., they are visible after a set date or they are visible only for a limited period, etc. In the electronic chart system, you control all date-dependent objects with Display date and Approved Until dates. In the paper chart world, the Preliminary and Temporary Notices to Mariners represent the date dependency described above for S57 charts.

An important part of ENCs are the updates. Hydrographic Offices can issue two kinds of updates:

1. Incremental updates, which are small additions to original base cells.
2. Reissues and new editions, which are complete replacements of previous base cells and their updates.

All updates are date stamped and they may also contain date-dependent parts. You control usage of updates in the electronic chart system from Display date and Approved Until dates. Using Display date and Approved Until dates, you can view your charts correctly drawn on any date in the past or in the future.

Chart material will be stored in media such as CD ROMs and USB flash memory or electronically through from LAN (Local Area Network) in which it could have arrived in CD ROMs or USB memories. Such material can contain only basic cells, cells and updates or only updates. The electronic chart system contains as standard the software required to access CD ROMs or USB flash memory.

Each S57 chart may contain additional links to textual descriptions or pictures, besides the chart itself. Typically additional textual descriptions and pictures contain important sailing directions, tidal tables and other traditional paper chart features that do not have any other method to be included into the S57 chart. This system copies these textual descriptions and pictures into its SSD so the user may cursor-pick them for viewing purposes.

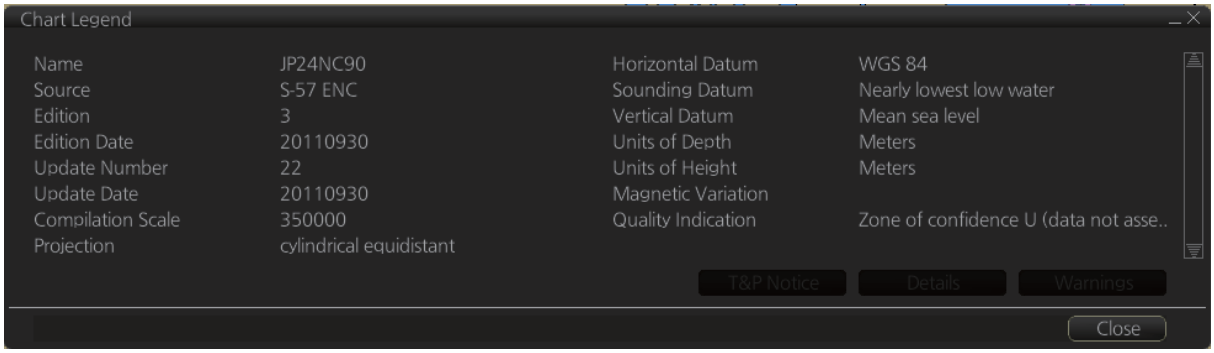
9.1.1 Definitions of terms

Cell	A cell is a geographical area containing ENC data and it is the smallest division of ENC data. Each cell has a separate unique name. Hydrographic Offices divide their responsibility area by the cells that they publish.
S57 chart	A database, standardized as to content, structure and format, is issued for use with this system without any authority of government-authorized Hydrographic Office.
ENC	A database, standardized as to content, structure and format, is issued for use with this system on the authority of government-authorized Hydrographic Offices. The ENC contains all the chart information necessary for safe navigation and may contain supplementary information in addition to that contained in the paper chart (e.g., sailing directions) that may be considered necessary for safe navigation. The name of the coding standard for ENC is S57ed3.
SENC	A database resulting from the transformation of the ENC by the system for appropriate use, updates to the ENC by appropriate means, and other data added by the mariner. It is this database that is actually accessed by the system for display and other navigational functions. The SENC may also contain information from other sources.

9.1.2 Chart legend for S57 charts

The chart legend provides various data about the chart currently displayed. To find info for current position, turn on RM reset, then click the [Chart INFO] button on the InstantAccess bar followed by the [Chart Legend] button. To find info for a specific location, turn on TM/CU reset, put the cursor on the location then right-click and select [Chart Legend]. Click the Close button to close the display.

This system is capable of showing more than one S57 chart at a time. This feature is called the multi-chart display. If one S57 chart does not cover the whole display, the system will open more S57 chart cells for display, if appropriate cells for the displayed area are available. The chart legend shows information about S57 charts displayed on the electronic chart display area.



Name: Name of chart.
Source: Source of chart.
Edition: Edition number of the chart.
Edition Date: Date the edition was published.
Update Number: Update number
Update Date: Date of update
Compilation Scale: The scale of the original paper chart is shown here.

Projection: Projection of current chart.
Horizontal Datum: Horizontal datum used with current chart.
Sounding Datum: Datum used to create sounding data.
Vertical Datum: Vertical datum used with current chart.
Units of Depth: Unit of depth used with current chart.
Units of Height: Unit of measurement used to measure height of objects above sea level.
Magnetic Variation: Amount of magnetic variation. A positive value indicates a change in an easterly direction and a negative value indicates a change in a westerly direction.
Quality Indication: Quantitative estimate of the accuracy of chart features, given by the chart producer.

9.1.3 Permanent warnings for S57 charts

Permanent warnings help you keep the S57 charts up-to-date and these are shown at the bottom of the screen. Permanent warnings appear if the system detects a condition that may cause a chart to be not up-to-date.

Message	Meaning, Remedy
Display date is not current	Display date is not the current date. Set Display date and Approved until date to the current date.
ENC: permits have expired	The system found an expired permit for a chart. Remove the chart or renew subscription for the permit.
ENC: Product list not uptodate	The product list is not up to date. Update the product list.
ENC: AIO product list not uptodate	At least one AIO chart is not be up to date. Load updated material.
No connection to dongle	The dongle is not inserted. Insert the dongle to erase the message.
Not up to date (SSE 27): XXXXXXXX (Chart name appears at location of Xs.)	At least one chart is not up to date. Load updated material.
Permit expired (SSE 25): XXXXXXXX (Chart name appears at location of Xs.)	You have an expired permit for a chart. Remove the chart or renew subscription for the permit.

Note: The system can assist in keeping RENC-received charts up-to-date. For charts that have been loaded from sources other than an RENC, the system is unable to know the exact up-to-date situation.

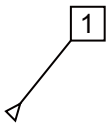
9.2 Sailing Directions, Tidal Tables, etc., Features of S57 Charts

S57 charts contain sailing directions, tidal tables and other textual and picture information that are not immediately visible on the chart. This information forms an integral part of the legal ENC chart that can fulfil SOLAS requirements. As a navigator you should check them as well as you check the visible chart when you do your planning and when you perform navigation.

Because these features are not permanently visible on the chart as they used to be in case of a paper chart, the system has special symbols to highlight the locations from which you can use the Info request to know additional information about the above-mentioned features. Below are examples of these symbols.

A grey box is used to show that tidal information is available for Info request by cursor pick. The visibility of this symbol is controlled by the item [Depth contours, magnetics, currents] in the [Other] page of the [Chart Display] menu.

A magenta-colored symbol is used to show that additional textual or picture information such as sailing directions are available from Info request by cursor pick. The visibility of this symbol is controlled by the item [Additional Information Available] in the [Other] page of the [Chart Display] menu.



9.3 Chart Viewing Dates and Seasonal Features of the S57 Chart

9.3.1 Introduction

S57 charts contain date-dependent features. Updating in general, including reissues, new editions and updates, creates date dependency. In addition to the obvious date dependency, some features of the S57 charts create additional date dependency. These features include "Date Start", "Date End", "Seasonal date start" and "Seasonal date end". Hydrographic Offices use these features to publish Temporary and Preliminary Notices to Mariners, as their paper chart equivalent updates are called. "Seasonal date start" and "Seasonal date end" are used for seasonal chart features such as summer-only sea marks, seasonal yacht race areas, etc.

You can efficiently use chart viewing date dependency in order to use the valid data for any given date applicable for your navigation or planning purposes. For example, you can check for existence of changes and restrictions weeks before they became valid. Date dependency is a part of the new electronic method to keep your chart up-to-date and valid for your intended use. Normally you should set Display date and Approved Until once per week to keep your chart up-to-date.

9.3.2 How to approve and highlight S57 chart updates

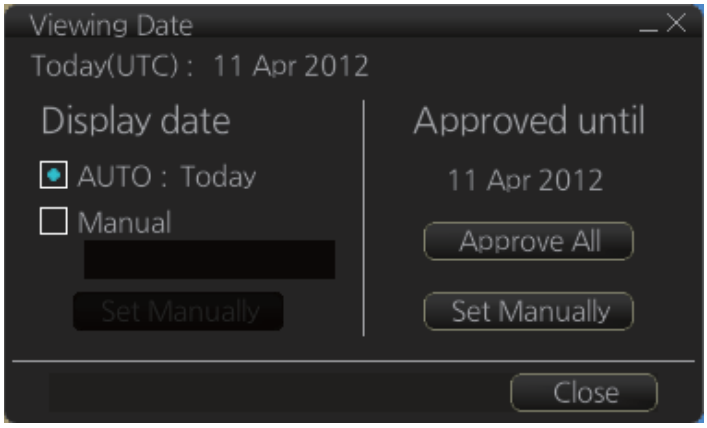
Before you approve updates, you can display (highlight) updates that are included into S57 charts. Normally you have selected for automatic after the SENC conversion. In this case, after all the SENC conversions have been finished, all updates are automatically highlighted and you can view and approve them after viewing. See the next section for how to set Display date and Approved until dates.

If you want to review updates after the initial approval of the updates do the following:

1. Use [Approved until] to set the begin date for the update highlight. See the next section.
2. Use [Display date] to set the end date for the update highlight. See the next section.
3. Review the changes. Added features are highlighted with orange circles. Removed features are highlighted with orange slashes. Changed features are highlighted with both orange circles and slashes.
4. After reviewing, set [Approved until] and [Display date] back to the current system date.

9.3.3 How to set Display date and Approved until dates

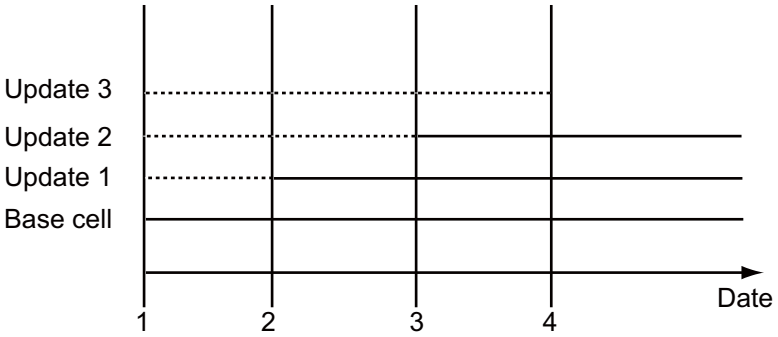
Click the [Chart INFO] and [Viewing Dates] button on the InstantAccess bar to show the [Viewing Date] dialog box. Set desired dates then click the [Close] button.



9.3.4 About chart viewing date dependency of S57 standard

How the issue date of updates changes the visibility of the changes

Study the example below to understand the behavior of updates relative to date.



The figure above shows how updates are dependent Chart viewing dates set in Display/Approved date settings by user. Actions 1 to 4 areas as follows:

1. Base cell including three updates is converted into SENC. Display date is set as current date of the system. Approve date has to be set to current date.

2. The date in which update 1 was issued. Display and Approved dates have to be set to correct date in order to see the chart with update 1.
3. The date in which update 2 was issued. Display and Approved dates have to be set to correct date in order to see the chart with update 1 and update 2.
4. The date in which update 3 was issued. Display and Approve dates have to be set to correct date in order to see the chart with update 1, update 2 and update 3.

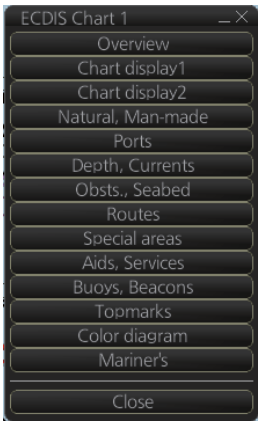
Note 1: In order to display charts with correct updated situation, always use current date during your voyage. If your voyage lasts more than one week, set current date at least once per week during your voyage.

Note 2: In order to display charts with correct updated situation during route planning, always use planned date of each waypoint to check your plan.

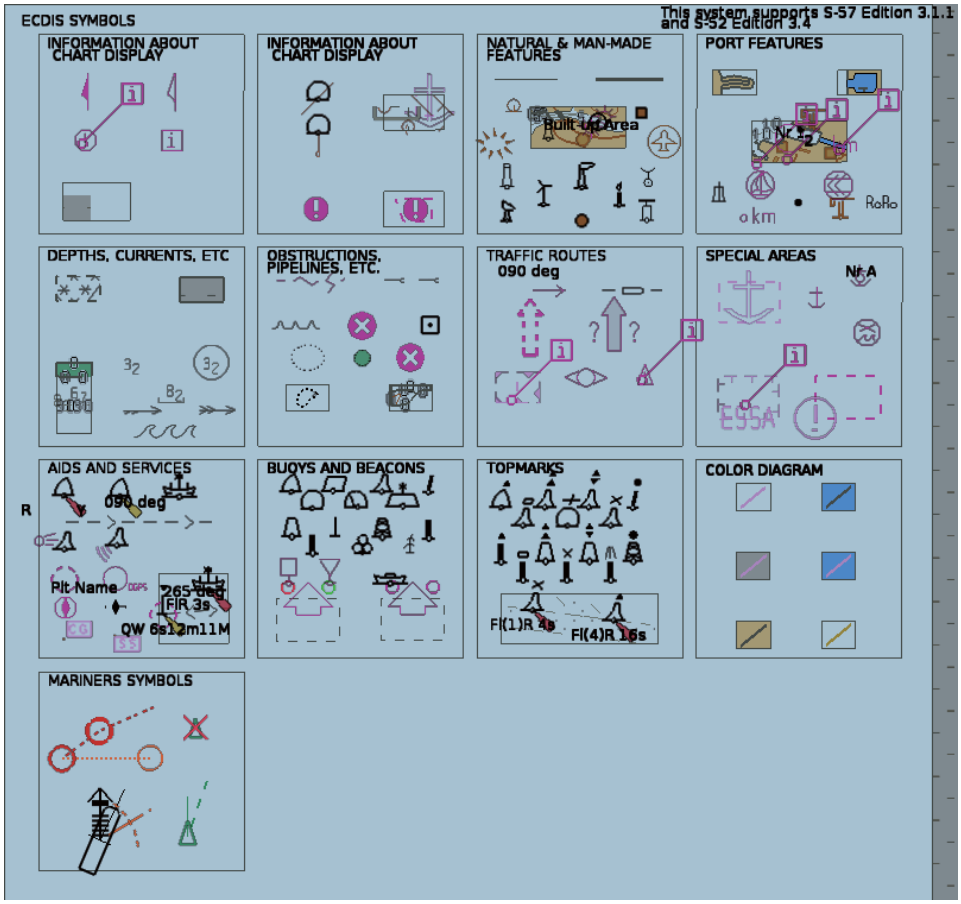
9.4 Symbology Used in S57 Charts

You can familiarize yourself with the symbology used by browsing IHO Chart 1, which is included in this system. Note that it behaves as any S57 chart and it follows your selections. See section 8.2.

1. Click the [Chart INFO] and [Chart 1] buttons on the InstantAccess bar to show to the [ECDIS Chart 1] menu, shown below.
2. Click a chart feature to show detailed information about the feature. Click [Overview] to show a compilation of all features, shown below.



ECDIS Chart 1 menu



9.4.1 Presentation library used for S57 chart features

The system uses the official IHO presentation library to draw S57 charts. The presentation library is replaceable, but this feature is only intended to be used by qualified service personnel and type approval authorities.

When this manual was published the official presentation library was "pslb03_4.dai", known as "Official IHO presentation library for system Ed 3 revision 1, Edition: 3.4".

9.5 How to Find Information About S57 Chart Objects

The ability to cursor-pick an object to find additional information about the object is an important function of the system. However, an unprocessed cursor pick, which does not discriminate or interpret and merely dumps on the interface panel all the information available at that point on the display, will normally result in pages of unsorted and barely intelligible attribute information.

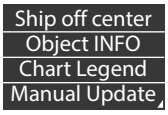
9.5.1 How to set visible S57 chart features

The request information about S57 chart objects is given only to objects that are chosen for display by the user. See section 8.2 for how choose the chart details to display.

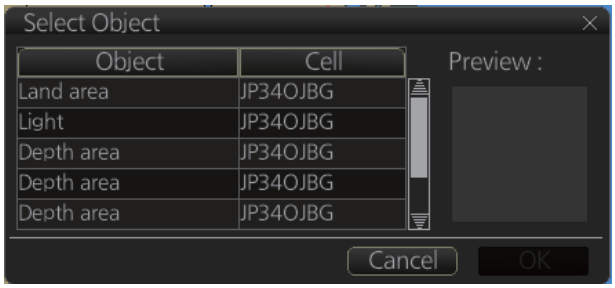
9.5.2 How to find information about a chart object

Do the following to find information about a chart object.

1. Get into the Voyage navigation mode then rIght-click an object to show the context-sensitive menu.



2. Click [Object INFO] to show the [Select Object] dialog box.



3. Click the object for which you want to know its details then click the [OK] button.

9.6 Admiralty Information Overlay (AIO)

The Admiralty Information Overlay includes all Admiralty Temporary and Preliminary Notices to Mariners (T&P NMs) and provides additional navigationally significant information from UKHO's ENC validation programme. The AIO is displayed as a single layer on top of the basic ENC and is available free of charge as part of the Admiralty S57 Chart Service and within Admiralty Value Added Resellers' services.

The AIO has been developed to ensure mariners can simply view the information they need - in addition to the standard chart - to navigate safely and compliantly. By clearly showing where important Temporary or Preliminary changes may impact a voyage, the Admiralty Information Overlay will give seafarers the same consistent picture of the maritime environment on their charts as they have always had.

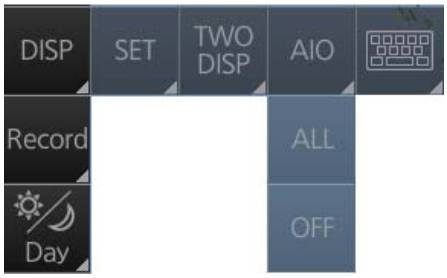
The AIO license is free of charge for AVCS license holders.

9.6.1 Installation

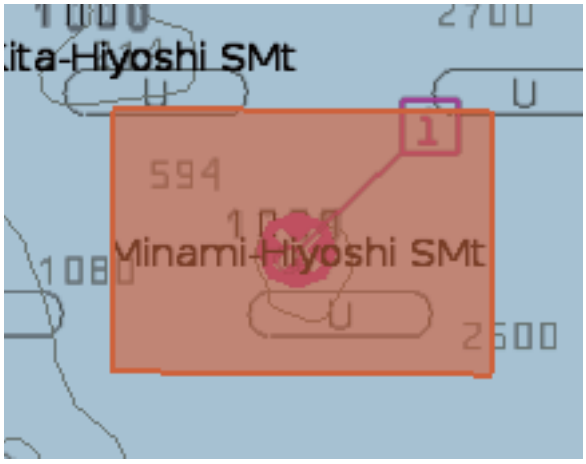
Installation is the same as that for the ENC chart. See section 7.3.

9.6.2 How to display the AIO

Click the [DISP], [AIO] and [ALL] buttons to show the AIO. To hide the AIO, click the [DISP], [AIO] and [OFF] buttons.

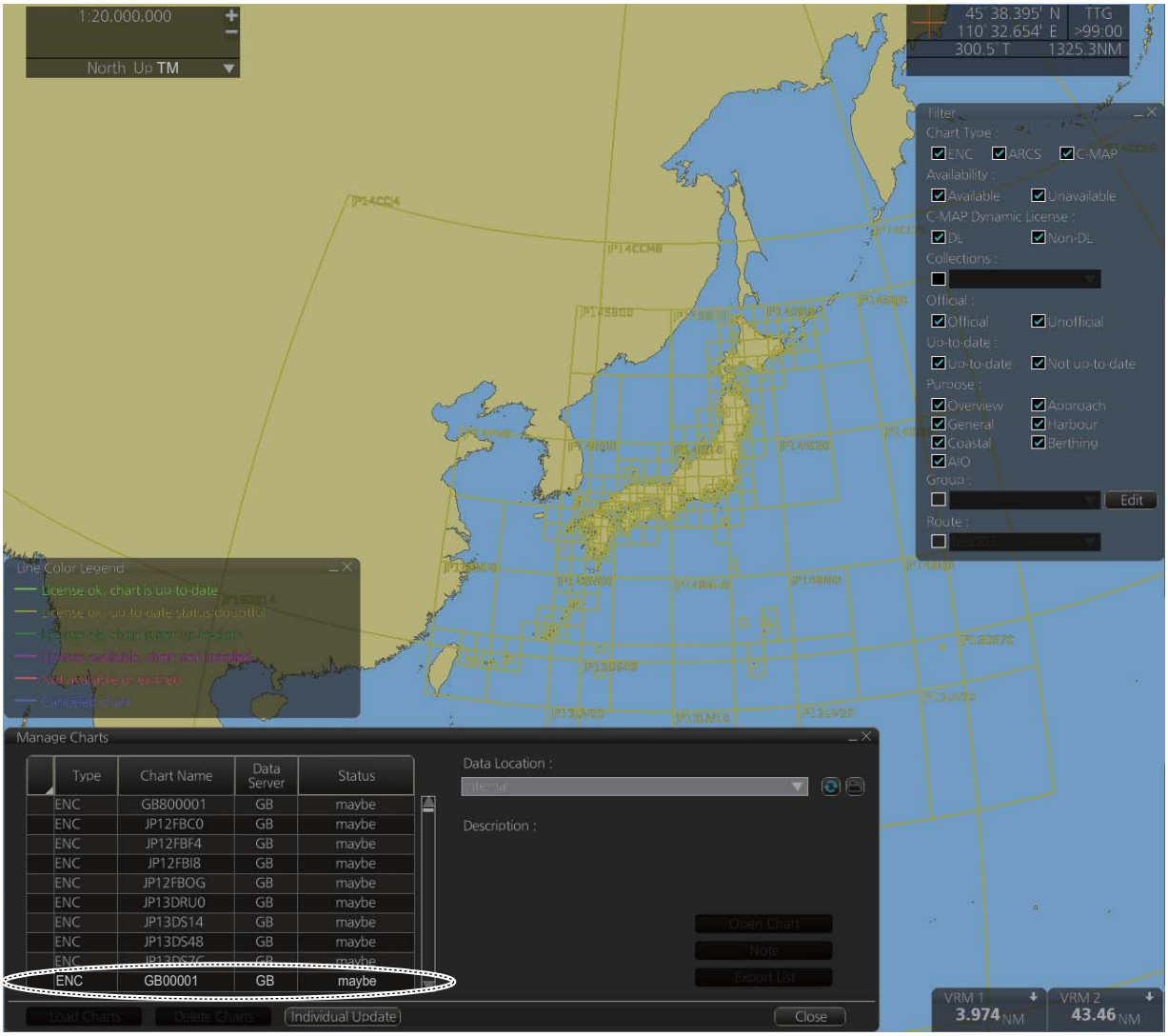


The area(s) that contain temporary or preliminary changes are marked with a hatched red rectangle.



9.6.3 Catalog of AIO cells

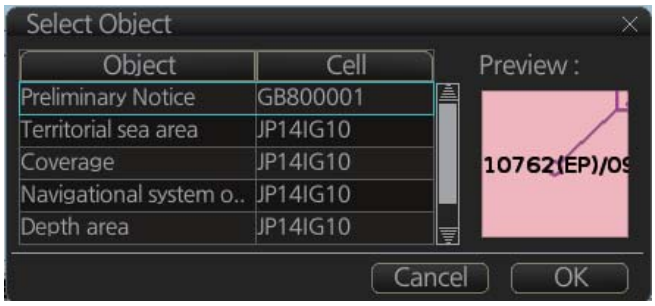
A catalog of AIO cells is maintained in the [Manage Charts] dialog box. To show this box, get into the Chart maintenance mode then click the [Manage Charts] button on the InstantAccess bar.



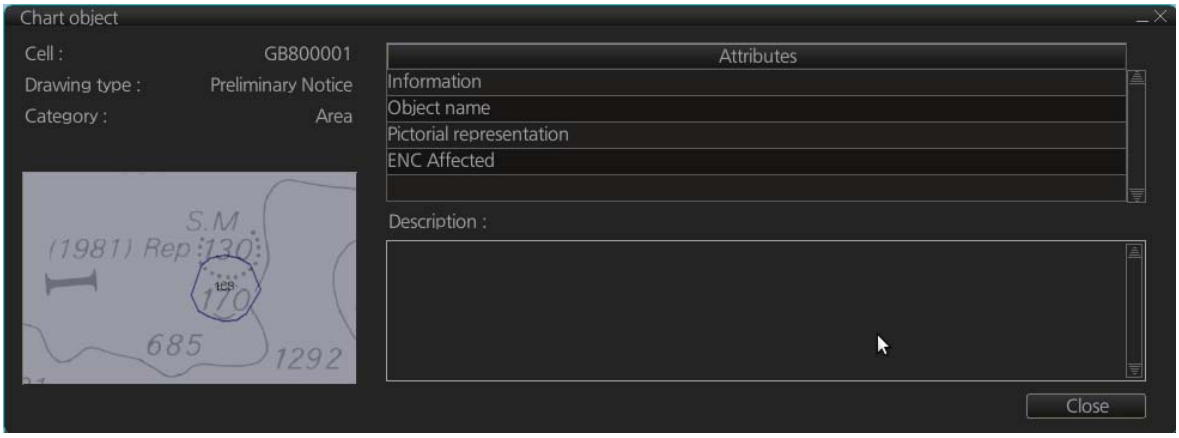
9.6.4 How to find AIO chart object information

Do the following to find chart object information contained in the AIO.

1. Click a red hatched area in the chart area to show the [Select Object] dialog box for the area selected.



2. Click "AIO object" in the dialog box to show the [Chart object] dialog box.



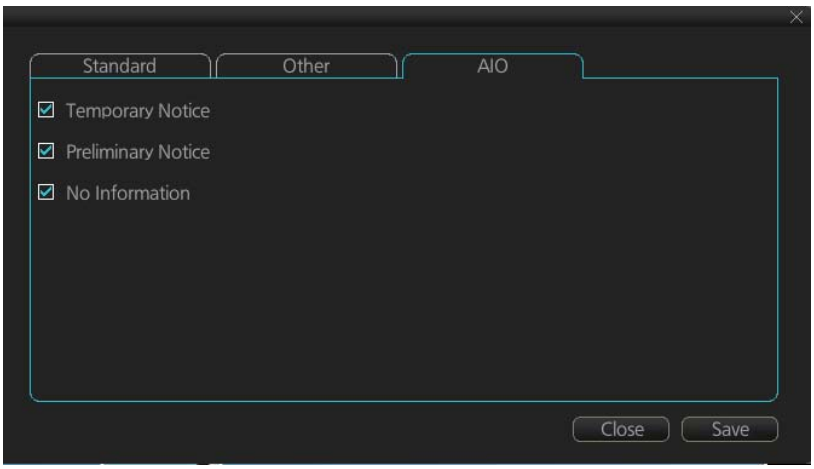
The [Chart object] dialog box shows the following information:

- Cell (name)
- Drawing type (Preliminary Notice, Temporary Notice)
- Category (AIO)
- The preview box provides a scaled-down image of the area selected. Click the image to enlarge it.
- The [Attribute] window shows the attributes for the AIO area selected. To find information about an attribute, click it to show its information in the [Description] box.
  Information: Description of area (for example, danger area).
  Object name: Object name (number)
  Pictorial representation: Associated diagram when applicable.
  Textual description: Full text of the Notice to Mariners (NM).
  ENC affected: ENC affected by the NM.

9.6.5 How to select the information to display

Select what type of notices to display as follows:

1. Click the [DISP], [SET] and [Chart DISP] buttons on the InstantAccess bar.
2. Click the [AIO] tab.



3. Check or uncheck items as appropriate.
4. Click the [Save] button to save settings then click the [Close] button to close the menu.

10. C-MAP CHARTS

The descriptions in this chapter apply to the CM-93/3 charts. (This system does not support CM-93/2 charts.)

10.1 C-MAP Cartographic Service

Your chart system has the capability of using and displaying the latest C-MAP world-wide vector chart database. These charts are fully compliant with the latest IHO S-57 3.1 specifications.

In order to prepare the system for use with the C-MAP database, there are a number of things that must be done.

10.2 How to Register the System at C-MAP Norway

Your system has the capability to use the C-MAP database. To do so an Aladdin eToken (supplied by C-MAP) must be connected to the system. The eToken provides the system with a unique System ID that enables C-MAP to issue correct licenses. The actual System ID can be found on the eToken itself, on the back of the installation CD box or on a sticker placed on the equipment. This ID must be provided on all chart orders, by e-mail (license@C-MAP.no).

10.3 How to Order Charts

A chart order may be sent together with system registration as described above. It is essential that the required information be sent to C-MAP when ordering charts for a system. C-MAP issues order forms specifying the information that is required, and contains vital information that will allows C-MAP to monitor and maintain your licenses throughout the lifetime of the system. Charts can be ordered by Zone, Area or Cell and these can be seen on the C-MAP web site or by downloading the Chart Product catalog also available on the web site. Price quotations can be obtained via your chart dealer or direct from your local C-MAP office. Once the license order has been prepared it should be emailed to license@C-MAP.no.

10.4 How to Apply for Licenses

Once the order has been received at C-MAP, a license will be generated and transmitted back to the operator. This may be in the form of a single alphanumerical string (16 characters), or in the form of a file called PASSWORD.USR. Once this license has been received it should be input using the License Administrator software designed and supplied by the chart manufacturer. There are two types of licenses, purchase and subscription. Purchase licenses are valid indefinitely while subscription licenses need to be renewed every 12 months from the start of the subscription. Failure to renew a subscription will result in the charts becoming unavailable.

10.5 Troubleshooting

If you are having problems installing your software or charts please check the following before contacting C-MAP:

- Check that the charts are available, with the chart management function.
- Check that the license is correctly installed, with the license function

Contact Information: For information or help please call you're nearest C-MAP Office (details can be found on the reverse side of the C-MAP chart CO box) or contact C-MAP Norway. E-mail: technical@C-MAP.no

10.6 Chart Subscription Services

10.6.1 C-MAP services

There are four different services available through C-MAP Cartographic service that can be used in this system. Two of them are using C-MAP format. These data sets contain two databases:

- CM-ENC (SENC delivery), Official Electronic Navigational Charts distributed by C-MAP on DVD.
- Global Chart Database, available on C-MAP professional CD-ROM. This database contains chart data original produced both by C-Map and Hydrographic Office.
- Global Chart Database, available on C-MAP professional+ DVD. This database contains chart data original produced both by C-Map and Hydrographic Office.
- C-MAP Dynamic Licensing (DL), available on DVD or online, in C-MAP SENC format. The C-MAP DL service ensures immediate access to ENC licenses whenever they are needed. ENC licenses available in seconds automatically via online C-MAP service providers. Cost is controlled via pre-set budgets and spending limits, giving shipowners a true "pay-as-you-go" service. For further details about C-MAP DL, contact a C-MAP provider.

  Note 1: CM-ENC is available. If you change CD-ROM service to DVD service, you need to also have a new license for the DVD service. Contact your chart agent or C-MAP for details.

  Note 2: PC and internet connection with e-mail are required. Further it is necessary to access Jeppesen approx. once every two weeks.

  Note 3: The Jeppesen eToken for the FEA-2xx7 series ECDIS cannot be used.

10.6.2 What is ENC delivery?

ENCs can be distributed as ENC delivery or SENC delivery. Both deliveries can be used in this system.

In ENC delivery charts are distributed directly from source like PRIMAR, IC-ENC, JHA, etc. They are delivered onboard in ENC format (using S-57 and S-63) then charts are loaded into the system.

In SENC delivery charts are converted from ENC to SENC before delivery to onboard and loading to the system. A CM-ENC delivery is SENC delivery.

Important notices

- If you are using both services (ENC and SENC deliveries) having the same chart name loaded into the system through both deliveries, priority of displaying the chart is in ENC delivery.
- Chart updates for ENC delivery are only for charts of ENC delivery and chart updates for SENC delivery is only for charts of SENC delivery. You have to keep charts up-to-date separately.
- If you change from ENC delivery to SENC delivery, remove old charts from the system before loading charts from new delivery.

10.7 Chart Display

10.7.1 Introduction

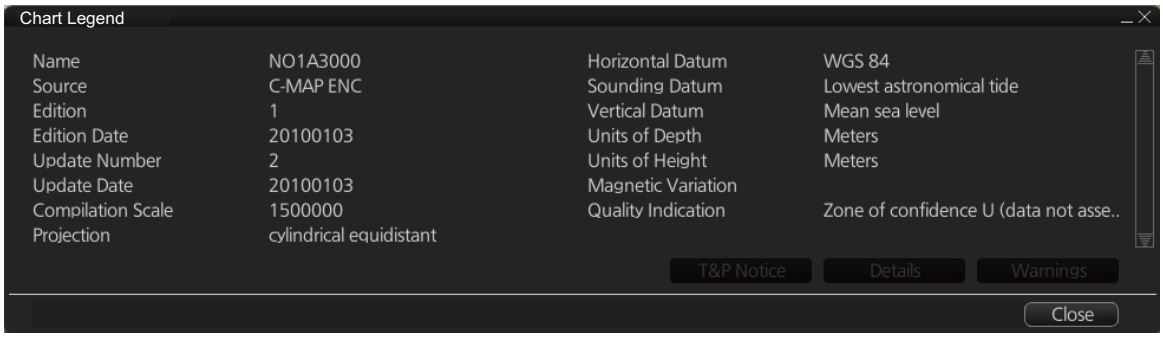
C-MAP charts are S57 charts displayed together with ENC (S57) and CM93/3 charts. These charts have the priority order shown below.

1. CM- ENC
2. C-MAP 93/3 Prof and C-MAP 93/3 Prof+

If the same navigational purpose charts are available over an area, priority is as shown above. Areas where ENC is not available CM-ENC charts are shown. Where C-MAP Prof or CM93 Prof+ are available, CM 93/3 charts are displayed.

The chart legend provides various data about the chart currently displayed. To find info for current position, click the [TM/CU Reset] button then click the [Chart INFO] button on the InstantAccess bar followed by the [Chart Legend] button. To find info for a specific location, put the cursor on the location then right-click and select [Chart Legend]. Click the Close button to close the display.

This system is capable of showing more than one chart at a time. This feature is called the multi-chart display. If one chart does not cover the whole display, the system will open more chart cells for display, if appropriate cells for the displayed area are available. The chart legend shows information about charts displayed on the electronic chart display area.



Name: Name of chart.
Source: Source of chart.
Edition: Edition number of the chart.
Edition Date: Date the edition was published.
Update Number: Update number

Update Date: Date of update
Compilation Scale: The scale of the original paper chart is shown here.
Projection: Projection of current chart.
Horizontal Datum: Horizontal datum used with current chart.
Sounding Datum: Datum used to create sounding data.
Vertical Datum: Vertical datum used with current chart.
Units of Depth: Unit of depth used with current chart.
Units of Height: Unit of measurement used to measure height of objects above sea level.
Magnetic Variation: Amount of magnetic variation. A positive value indicates a change in an easterly direction and a negative value indicates a change in a westerly direction.
Quality Indication: Quantitative estimate of the accuracy of chart features, given by the chart producer.

10.8 Permanent Warnings

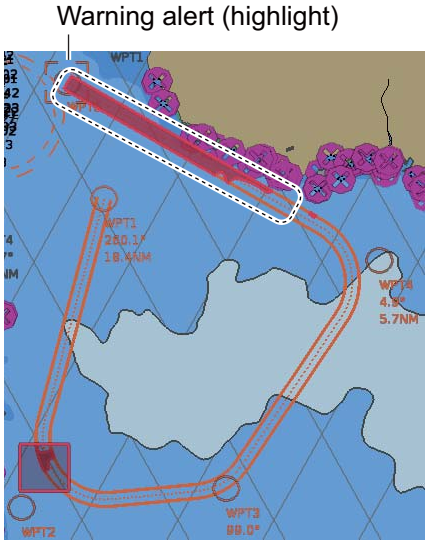
Permanent warnings help you keep the C-MAP up-to-date and these are shown at the bottom of the screen. Permanent warnings appear if the system detects a condition that may cause a chart to be not up-to-date.

Message	Meaning, Remedy
CMAP: Database not uptodate	Database is not uptodate. Update the data base.
CMAP: Dynamic license reporting overdue	You have not requested an update file for more than one week. Get into the Chart maintenance mode then click the [License] button. Click the [C-MAP] tab then the [Order Update File] button.
CMAP: Dynamic licensing credit limit	You have exceeded the allotted credit limit. Raise credit limit.
CMAP: No connection to eToken	eToken dongle is not inserted (inside the Processor Unit) or eToken has not been initialized. To initialize eToken, open the [License] dialog box then click the [C-Map Setup] and [OK] buttons.
CMAP: permits have expired	You have an expired permit for a chart. Remove the chart or renew subscription for the permit.
No connect to dongle.	Dongle not inserted. Insert dongle.
Not up to date (SSE 27): XXXXXXXX (Chart name replaces Xs.)	At least one chart is not up to date. Load updated material.
Permit expired (SSE 25): XXXXXXXX (Chart name replaces Xs.)	You have an expired permit for a chart. Remove the chart or renew subscription for the permit.

11. CHART ALERTS

The chart radar can detect areas where the depth is less than the safety contour or detect an area where a specified condition exists. If prediction of own ship movement goes across a safety contour or an area where a specified condition exists, the system does the following:

- Highlights warning alert objects in red (route checked in route planning, and route navigation)
- Provides visual alerts in the [Alert] box for warning alert objects (route navigation)
- Sounds an aural alarm for warning alert objects (route navigation)



For this function, the chart radar utilizes the chart database (S57 charts) stored on the SSD in SENC format. **Note that the chart radar calculates dangerous areas using the largest scale chart available, which may not be the visualized chart.**

You can choose objects that are included for calculation of danger area (for example, restricted areas). A dialog box lists the various areas that activate danger warnings.

You can also define your own safe area by creating a user chart area. The system can utilize these areas when calculating chart alerts.

- The ECDIS can check the following for you:
  - Predicted movement area of own ship
  - Planned route with an easy to use locator function to find dangerous areas
- The ECDIS will highlight the following for you
  - Dangerous areas inside predicted movement area of the own ship
  - Dangerous areas inside your monitored route
  - Dangerous areas inside your planned route

11.1 Chart Alerts

Official S57 chart material contains depth contours that can be used for calculation of chart alerts. A chart database also includes different types of objects that the operator can use for chart alerts. The procedure for setting chart alerts is outlined below.

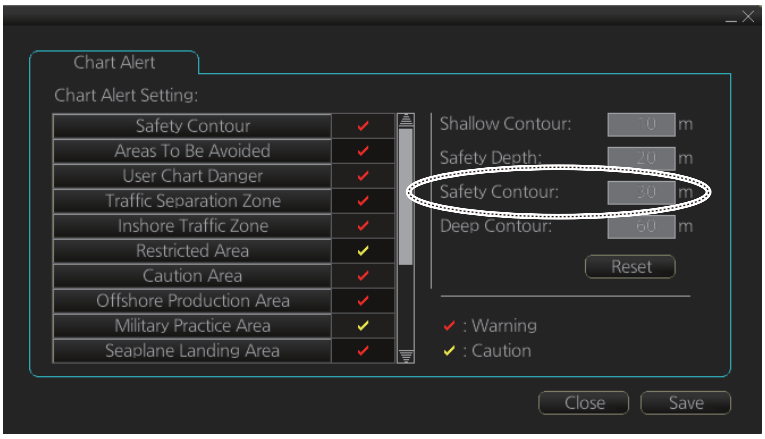
1. Choose suitable safety contour for your own ship. See the next section for how to set the safety contour.
2. In the Voyage planning mode, define a new route or choose an existing one. Make a chart alert calculation of the route if there are indications of danger areas in the route. Modify your route if necessary and do the chart alert calculation again. To modify an existing route see section 12.5.
3. Choose route as monitored route.
4. Set check area for your own ship.

The system is now ready for chart alert calculation of monitored route and estimated own ship position.

11.1.1 How to set safety contour

Select safety depth suitable for the own ship.

1. Click the [DISP], [SET] and [Chart DISP] buttons on the InstantAccess bar to show the [Chart Alert] page.



2. Enter desired depth at [Safety Contour] then click the [Save] button.

A depth contour is created on the chart according to the safety contour value entered.

Note: If the chart does not contain chosen depth contour, the system will automatically choose next deeper contour.

11.1.2 How to select objects used in chart alerts

You can also include calculation areas that have to be noted when sailing (for example, restricted areas). To include these areas in chart alerts, do the following:

1. Click the [DISP], [SET] and [Chart Alert] buttons on the InstantAccess bar to show the [Chart Alert] page.

In the example above, a caution alert (visual) is provided when your vessel nears a restricted area and a military practice area and both visual and aural alerts are provided for all other items.

List of areas

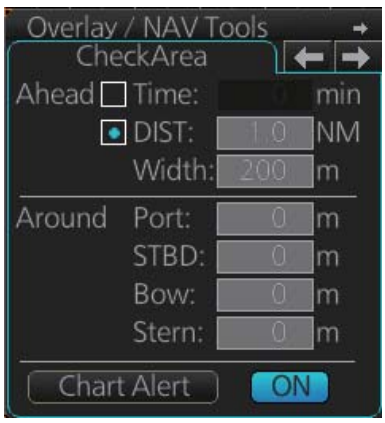
There are the areas that the chart radar detects and provides the audible alert and/or visual alert if estimated own ship position or planned or monitored route crosses the area defined on the [Chart Alert] page. You can choose from the following areas:

- Safety Contour
- Areas To Be Avoided
- User Chart Danger
- Traffic Separation Zone
- Inshore Traffic Zone
- Restricted Area
- Caution Area
- Offshore Production Area
- Military Practice Area
- Seaplane Landing Area
- Submarine Transit Lane
- Anchorage Area
- Marine Farm/Aqua Culture
- PSSA Area
- Non-official ENC
- No Vector Chart
- Not Up-to-date
- Permit Expired

11.2 How to Activate Own Ship Check

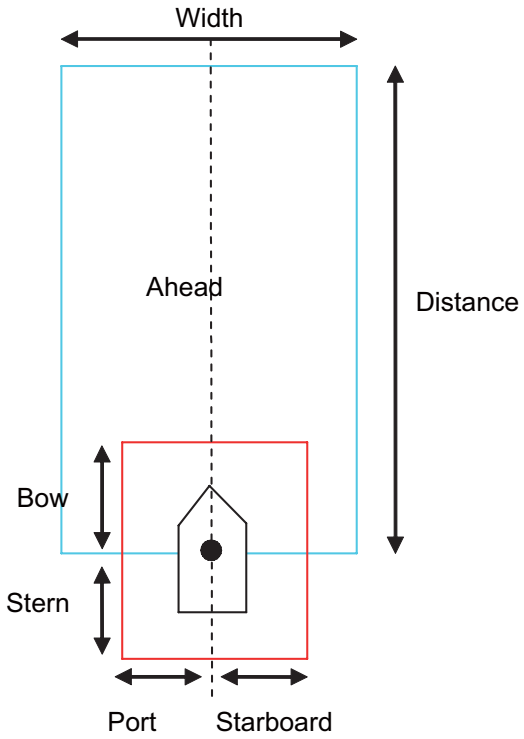
Calculation of own ship predicted movement area is done using a check area about own ship position. Set the check area as follows:

1. Select the [Check Area] page from the [Overlay/ NAV Tools] box.

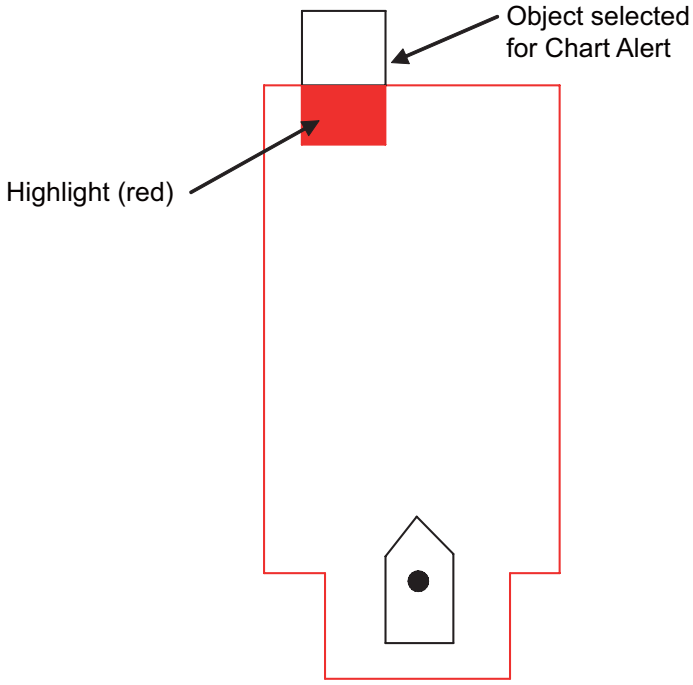


2. Set the ahead time or distance and ahead width, referring to the figure below. Also, set the "Around" figures: port, starboard, bow and stern check distance. The

reference point is the conning position. Click the [ON] button to activate the own ship check.



When an object having a Warning setting enters the Check Area, the object is highlighted in red and the aural alarm sounds.



11.3 Route Planning

The system will calculate chart alerts using user-defined channel limit for routes. Danger areas are shown highlighted if safety contour or user-chosen chart alert areas are crossed by the planned route. For more information on route planning, see chapter 12.

Note: If your voyage is going to take a long time or you are planning it much earlier than it is to take place, use the Display date and Approved until dates corresponding to the dates you are going to sail.

11.3.1 Chart alerts for route planning

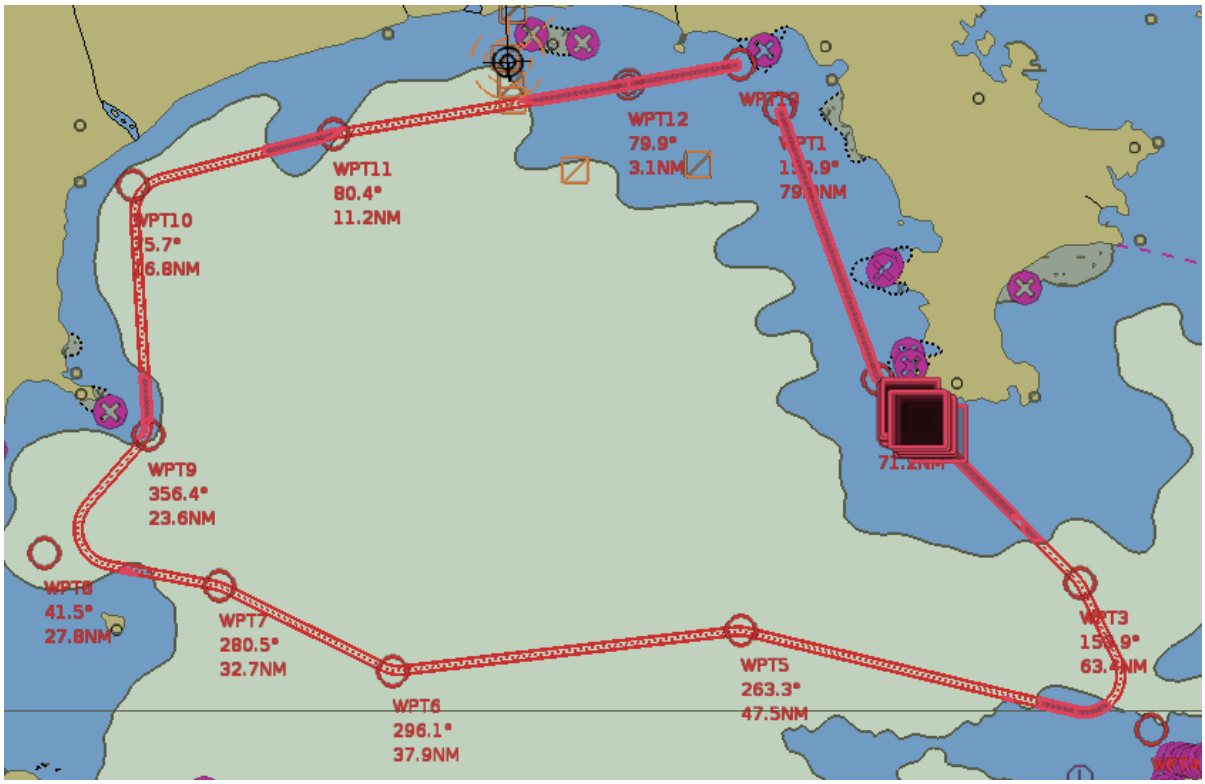
You can generate a list of chart alerts that cross by the planned route. This can be done as follows:

1. Enter safety contour you want to use.
2. Plan a route; define waypoints and other necessary information. See chapter 12 for route planning.
3. Choose dangerous objects to be monitored during route monitoring, on the [Alert Parameters] dialog box in the [Plan Route] dialog box, shown below.
   a) Click the [PLAN], [Planning] and [Route] buttons.
   b) Click the [Alert Parameters] tab.
   c) Click the alert to process. Show a red circle for visual and aural alerts, or yellow circle for visual alert.

4. Click the [Check Route] button to generate a list of chart alerts. The results appear on the [Check Results] page.

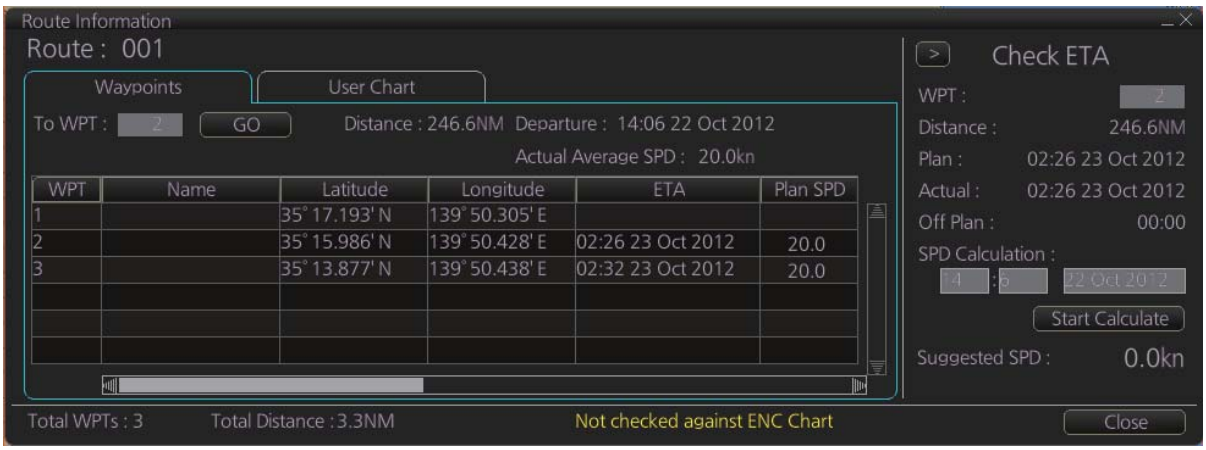
The figure above shows the alerts to be monitored. If there are alerts included in the planned route, check alerts leg by leg, or check alerts by using category of alert.

11.4 Route Monitoring



- When the ship enters a check area specified as a caution alert, a visual alert is generated. Neither the object in the area or the route is highlighted.
- When the ship enters a check area specified as a warning alert, a visual alert is generated and the object and route are highlighted.
- A red box(es) indicates an area having several highlighted objects.

The system has a route monitor that facilitates safe use of routes. You can check your route plan for safe water and you can attach a user chart and Notes that you intend to use together with a route plan. To show the [Route Information] dialog box, get into the Voyage navigation mode, then click the [Route] and [Route Information] buttons. Click the [Waypoints] tab.



12. ROUTES

12.1 Route Planning Overview

A route plan defines the navigation plan from starting point to the final destination. The plan includes:

A route plan defines the navigation plan from starting point to the final destination. The plan includes:

- Route name
- Name, latitude and longitude of each waypoint
- Radius of turn circle at each waypoint
- Safe channel limits
- Chart alarm calculation based on channel limits against chart database and user chart danger
- UKC calculation
- Deadband width, nominal deadband width used for the chart operating modes with moderate accuracy and economical sailing behavior
- Minimum and maximum speed for each leg
- The navigation method (rhumb line, great circle)
- Fuel saving
- ETD for the first waypoint
- ETA for the last waypoint
- Ship and environmental condition affecting the ship speed calculation
- Name of the user chart to use during route navigation together with the planned route
- Name of the Notes to use during route navigation together with this planned route, in the user chart dialog box

Using the above-mentioned data, the system calculates speed, course and length for each leg, ETAs for each waypoint, fuel consumption and WOP. It also calculates safe water areas based on user-defined channel limits. The calculated data is displayed in tabular form, which can be printed as a documented route plan and also stored in a file for later use.

Main functions of route planning are:

- Define waypoints
- Define turnings for each waypoint
- Define channel limits for each leg (a leg is the line connected between two waypoints). The channel limits are used to detect chart alerts when you are planning or monitoring your route.
- Define the speed for each leg
- Calculation for ETD and ETA
- Calculation for most economical sailing

Note: Limitation of displayed route

If you have small scale chart(s) on display having the whole eastern/western (0-180°E/0-180°W) hemisphere and a part of the other hemisphere on display, there is a limitation to display a route. To avoid this, set chart center so that the whole eastern/western hemisphere is not on the display. A maximum of five routes can be edited simultaneously.

12.2 Main Menu for Route Planning

The main parameters for the route planning are:

- Latitude and longitude of the waypoint
- Channel limits to the waypoint
- Turning radius of the waypoint
- Maximum speed limit and planned speed for each leg

There are two phases for a route: Route Plan and Route Monitor. Route plan is used for planning the route and route monitor is used to control a route for monitoring.

To complete route planning, do the following.

1. Create a new route or choose an existing one. See section 12.3.
2. Modify your route if necessary. See section 12.5.
3. Make chart alert (safe water) calculation. See section 12.3.5.
4. Optimize your route. See section 12.8.

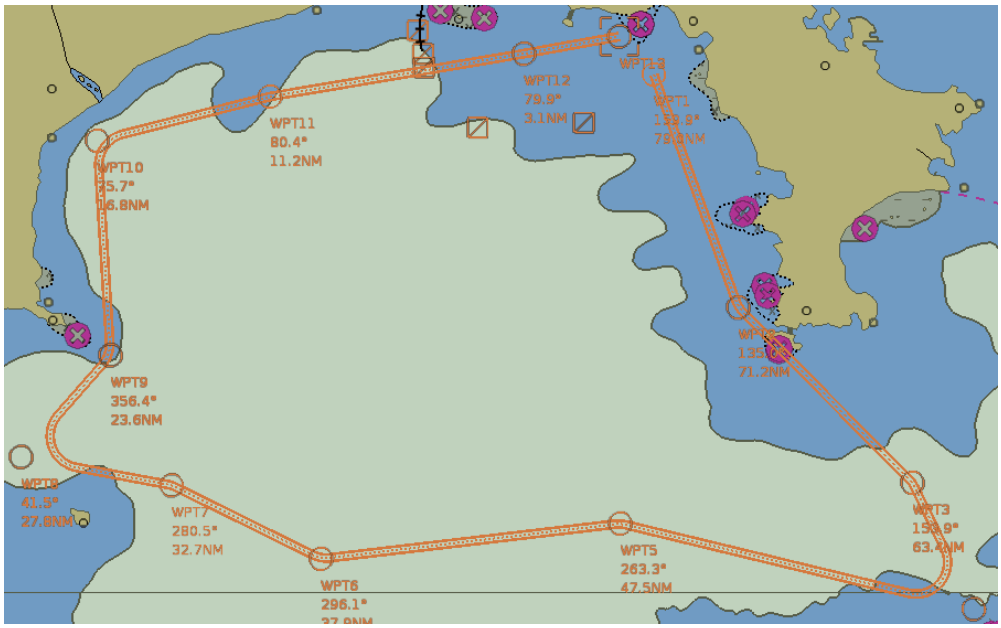
12.3 How to Create a New Route

To make a complete route for a voyage, do the following:

1. Click the [PLAN] button on the Status bar to activate the Voyage planning mode.
2. On the InstantAccess bar, click the [Planning] button followed by the [Route] button to open the [Route Plan] dialog box.

3. Click the [New] button.
4. Use the cursor to select a position for the first waypoint then push the left mouse button. A waypoint mark appears on the position selected, and the latitude and longitude of the position are entered into the [Route Plan] dialog box. After entering a waypoint, edit Name, Steering mode, Radius, Channel limit, Plan SPD, SPD Max and Margin as appropriate in the [Route Plan] dialog box, using the keyboard on the Control Unit or the software keyboard. (For other than steering mode, put the cursor on an item to show up and down arrows. Put the cursor on an arrow and click to change setting.)
   Note: A guide box that shows the range and bearing between waypoints as you drag the cursor is available. You can show or hide the box with the [Guide Box] button on the InstantAccess bar. Click the button to show its background color in light-blue to display the guide box.

5. Repeat step 4 to enter other waypoints.
6. After you enter the final waypoint, right-click the display area to show the context-sensitive menu then select [Finish].
7. Click the [Save] button. Enter a name (max. 53 alphanumeric characters) for the route, using the keyboard on the Control Unit or the software keyboard. Click the [OK] button to finish.
8. Use the [Alert Parameters] page to define the safety contour and other specified conditions for checking the route. Click a "block" under a safety item to show a red circle to get check boxes and highlights or yellow circle to get the highlight. A parameter can also be assigned globally to all legs from the context-sensitive menu. See section 12.3.4 for how to use the [Alert Parameters] page.
9. Use the [Check Route] button on the [Alert Parameters] page to detect areas where the depth is less than the safety contour or where specified conditions exist. The results appear on the [Check Results] page. This system can examine chart database against planned route to make a list of alerts where a route crosses a safety contour or specified areas used in chart alerts.
10. Use the [User Chart] page to link, de-link a user chart(s) with the route. See section 12.3.2.
11. Use the [Optimize] page to enter parameters for route optimization.Se4e section 12.3.3.



How to use the Undo feature

The Undo feature, available when creating a route and a user chart, can be accessed from the [Undo] button on the InstantAccess bar, use double-click, or the context-sensitive menu. In route creation the feature is used with waypoint and text input as follows:

Waypoint input: Delete last-entered waypoint.
Text input: Erase last-entered character or character string.

12.3.1 How to use the Waypoints page

The following fields and boxes can be found in the [Waypoints] page. Scroll the list rightward to see hidden items.

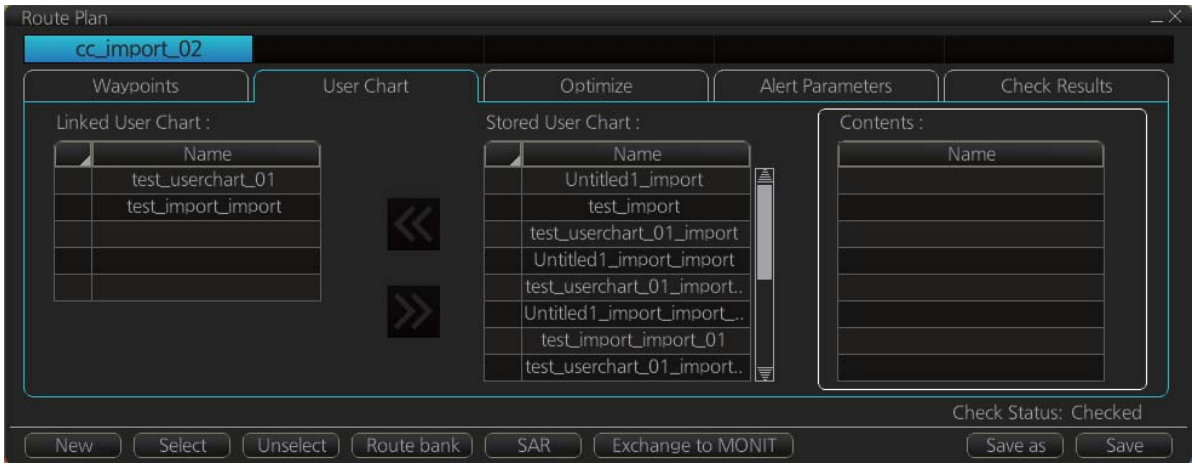
WPT: Each waypoint has a number. **Name**: You can name each waypoint. Latitude: WPTs latitude coordinate is displayed in selected datum. Longitude: WPTs longitude coordinate is displayed in selected datum. Leg/°: Bearing of leg **Leg/NM**: Length of leg (nm). Str Mode: Define steering mode for each-leg - rhumb line or great circle. Click to select [Rhumbline] or [Greatcircle].	RAD/NM: Define turning radius for each waypoint. To change a radius, put the cursor in this column to show up and down arrows. Click the arrows to set the radius. Ch Limit/m: Define channel limit for each leg. Plan SPD: Define minimum speed to use with a leg. **SPD Max**: Define maximum speed to use with a leg. **Margin/m**: Define extension for channel to be checked against selected alerts.

Note 1: You can select the route information data to display on the [Waypoints] page with the context-sensitive menu. Right-click [WPT] or [Str Mode] then select [Edit columns] to show the context-sensitive menu. Check or uncheck items as appropriate then click the [OK] button.

Note 2: Processing waypoints with the context-sensitive menu. See section 12.4.3 - 12.4.5.

12.3.2 How to use the User Chart page

The [User Chart] page lets you link user charts to routes. To link a user chart, click the box to the left of the user chart name in the [Stored User Chart] list to show a check-mark. Click the << button to copy that name to the [Linked User Chart] list. To de-link a user chart, click the box to the left of the user chart name in the [Linked User Chart] list then click the >> button to erase the name. The contents of each user chart are shown in the [Contents] window.



Linked User Chart: List of user charts linked with selected route.
Stored User Chart: List of stored user charts.
<< button: Link a stored used chart. Check the chart in the [Stored user chart] list then click this button. The user chart name is then copied to the [Linked User Chart] list.
>> button: Click to remove selected (checkmarked) user chart from the [Linked User Chart] list.
Contents: Lists the objects saved to the user chart selected.

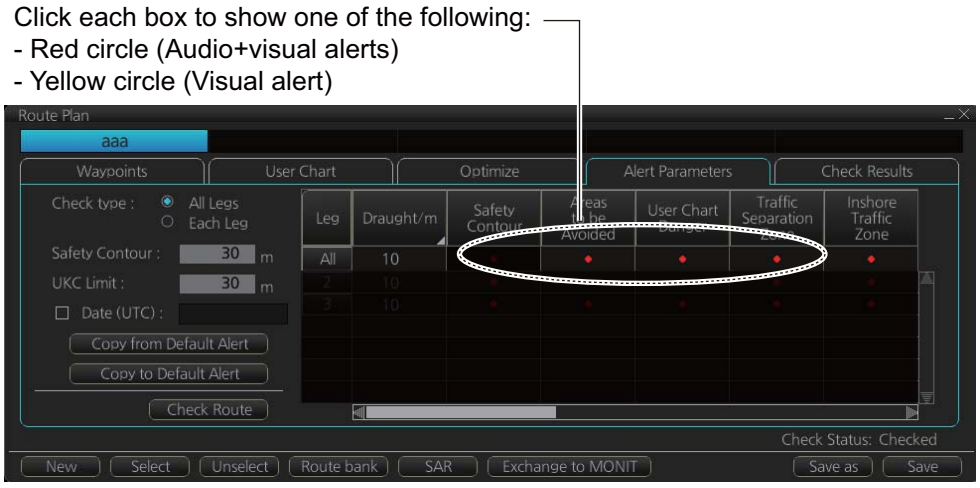
12.3.3 How to use the Optimize page

After all waypoints are inserted and you have made safe water calculation, you can optimize your route, on the [Optimize] page. If not chosen, then optimization will be done automatically with max. speed. If you want do optimization with a specific strategy, see section 12.8 for how to optimize a route.

Type: Select optimization strategy: maximum speed, time table, maximum profit, or minimum cost. A route may only be modified when using the north-up or course-up mode.
Set ETD: Set date, time and waypoint to start from.
Parameters: Set the parameters for optimization, speed limit and income (max profit).
Edit Cost Parameters button: Enter fuel consumption figures. See section 21.2.
Set ETA: For type [Time table], set the date and time that you want to arrive at the waypoint selected.
Optimized Speed/ETA: The optimized speed for the date and time entered at [Set ETA] appears here, after clicking the [Calculate] button.
Calculate button: Click to calculate optimization.

12.3.4 How to use the Alert parameters page

The [Alert Parameters] page lets you define conditions along a route for which you want to be alerted, by visual or audible indication. Put a red circle to get a visual alert (highlight the corresponding areas in red on the chart) and an aural alert. Put a yellow circle to get a visual alert. You can choose the safety contour and chart alerts used to check the safety of the route. This allows you to check the safety with conditions different from those chosen for system use. This is useful when making a route for different loading or sailing conditions.



Radio buttons, input boxes		Alert items	
Item	**Description**	**Item**	**Description**
Check type	Check how to apply the alerts, to every leg or individual leg.	Draught/m	Ship's draught
Safety Contour	Set the safety contour (in meters).	Safety Contour	Deep contour chosen for chart alert calculation. Use the keyboard on the Control Unit or spin the scrollwheel to set value.
UKC Limit	Under keel clearance limit.	Areas to be Avoided	Areas to be avoided
Date (UTC)	A chart may have date-dependent features. Enter the actual data of embarkation to know date-dependent features.	User Chart Danger	User chart danger area

Radio buttons, input boxes		Alert items	
Item	**Description**	**Item**	**Description**
[Copy from Default Alert] button	Copy the default alert settings to this route.	Traffic Separation Zone	Traffic separation zone
[Copy to Default Alert] button	Copy the alert settings for this route as default alert settings.	Inshore Traffic Zone	Inshore traffic zone
[Check Route] button	Click to check route for safe navigation. The results appear on the [Check Results] page.	Restricted Area	Restricted area
Leg	Leg number	Caution Area	Caution area
		Offshore Production Area	Offshore production area
		Military Practice Area	Military practice area
		Seaplane Landing Area	Seaplane landing area
		Submarine Transit Lane	Submarine transit lane
		Anchorage Area	Anchorage area
		MarineFarm Aquaculture	Marine farm aquaculture
		PSSA Area	Particularly Sensitive Sea Area
		Non-official ENC	No official ENC data
		No Vector Chart	No vector chart for area.
		Not Up-to-date	Chart not up to date.
		Permit Expired	Permit for chart has expired.

Context sensitive menus

A context-sensitive menu for setting the draught is available on the [Alert Parameters] page. Right-click [Draught] to show the menu. [Set "ALL" setting to all legs] applies the draught value of [Check type: All Legs] to all legs. [Clear setting] restores previous settings for each leg.

12.3.5 How to use the Check results page

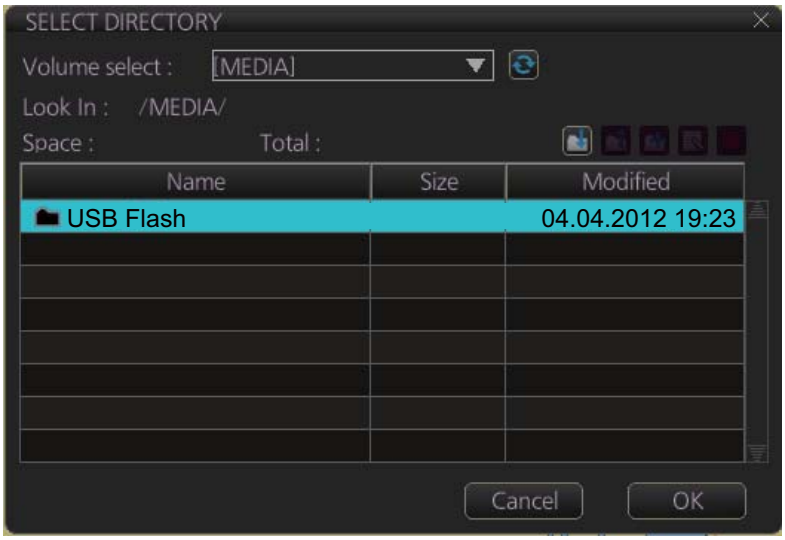
The [Check Results] page allows you to make safe water calculation for your route. Click the [Check Route] button to do the check. After the button is operated, the alert type and latitude and longitude position of the alert appear for applicable legs on the route.

Note: In order to display charts with correct updated situation, always use current date during your voyage. If your voyage lasts more than one week, set current date at least once per week during your voyage.

12.4 How to Import a Route Created with ECDIS FEA-2x07

Routes created at the ECDIS FEA-2x07 can easily be imported to this ECDIS. Copy the routes to a folder (see chapter 17 in the operator's manual of the FEA-2x07) in a USB flash memory then do as follows:

1. Set the USB flash memory to the USB port on the Control Unit.
2. Activate the Voyage planning mode.
3. Click the [Manage Data], [Data Import] and [Route] buttons to show the [SELECT DIRECTORY] dialog box.



4. Select the folder that contains the route(s) to be imported then click the [OK] button.

5. Check the route(s) to import then click the [Import] button.

12.5 How to Modify an Existing Route

12.5.1 How to change waypoint position

To change position of a waypoint you have the following choices:

- Enter latitude and longitude on the [Waypoints] page in the [Route Plan] dialog box.
- Drag and drop waypoint using the left button.

How to drag and drop waypoint to new position

1. Put the cursor on the route waypoint to move then push the right button to show the context-sensitive menu.
2. Select [Edit].
3. Press and hold down the left button while rolling the trackball to move the cursor to a desired position. Release the button when the cursor is at the desired position

How to change latitude and longitude from the Waypoints page

1. Show the [Waypoints] page.
2. Put the cursor on the digit to change in the Latitude or Longitude field.
3. Enter position from the Control Unit, or use the scrollwheel.

12.5.2 How to change other waypoint data

Other data of a waypoint, such as name, steering mode, turning radius, min/max speed, can be edited from the [Waypoints] page. Select the route to edit and open the [Waypoints] page. Put the cursor on a desired field and spin the scrollwheel to change data. (Push the left button to change steering mode.)

12.5.3 How to add a new waypoint at the end of a route

How to add a new waypoint at the end of a route from the electronic chart area

1. Put the cursor on the current last waypoint of the route.
2. Right-click the display area to show the context-sensitive menu then click [Edit].
3. Put the cursor to the new location for the last waypoint then push the left button.
4. Right-click, then click [Finish].

How to add a new waypoint at the end of a route from the Waypoints page

Open the [Waypoints] page then right-click the last waypoint. Select [Insert After]. A waypoint is added at the end of the list. Edit the Latitude, Longitude, etc. as necessary.

12.5.4 How insert a waypoint between waypoints

How to insert a waypoint between waypoints from the electronic chart area

Put the cursor on the leg of the route where you want to insert a waypoint. Right-click the display area to show the context-sensitive menu. Select [Insert]. Push the left button.

How to insert a waypoint from the Waypoints page

Open the [Waypoints] page then right-click the waypoint to process. Select [Insert after] or [Insert before] as appropriate. A waypoint is added after or before the waypoint selected. Edit the Latitude, Longitude, etc. as necessary.

12.5.5 How to delete a waypoint

How to delete a waypoint from the electronic chart area

Put the cursor on the waypoint to delete. Push the right button to show the context-sensitive menu then select [Edit] followed by [Delete WPT].

How to delete a waypoint from the Waypoints page

Open the [Waypoints] page. Right-click the waypoint you want to delete then select [Delete WPT].

12.5.6 Geometry check of route

When you add a new waypoint, modify a waypoint or change other waypoint data, the message "Impossible turn at WPT" may appear (in red). It means that the geometry of route makes it impossible for the ship to sail along a certain leg. Typically it is enough if you do the following, on the [Waypoints] page.

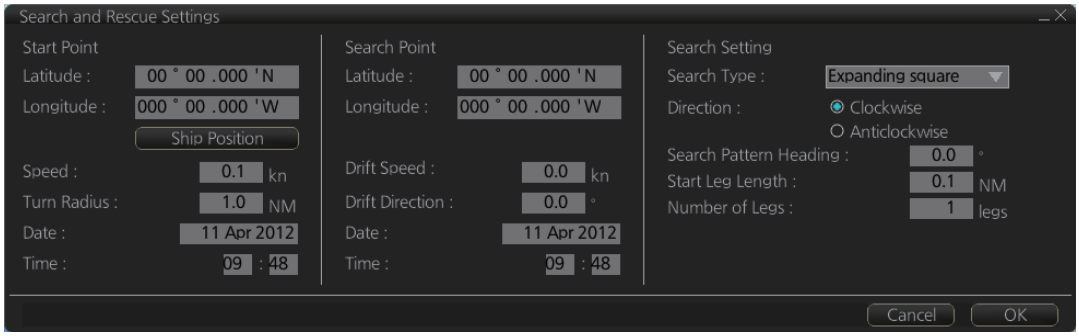
- Decrease the radius of turn of the waypoint or one of its neighbors.
- Increase the radius of turn of the waypoint or one of its neighbors.
- Change lat/lon position of the waypoint or one of its neighbors.
- Decrease plan speed.

12.6 SAR Operations

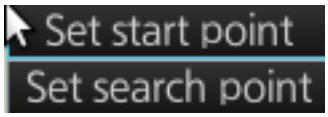
The SAR feature facilitates search and rescue operations for MOB.

To use the SAR feature, get into the Voyage planning mode then do the following:

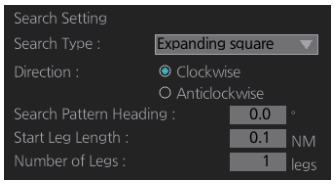
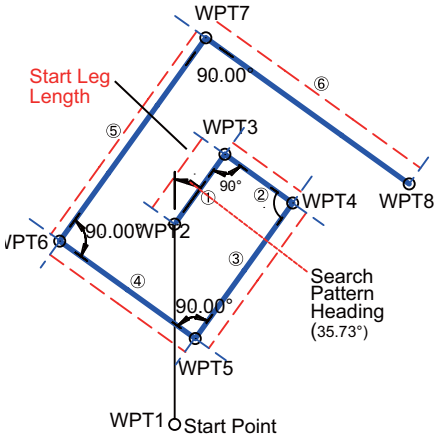
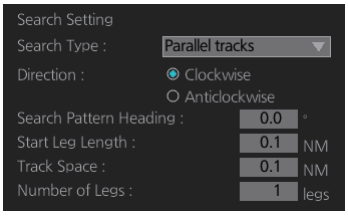
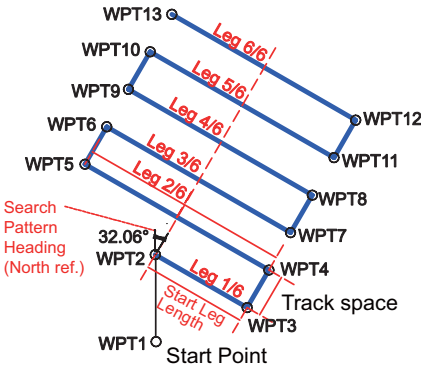
1. Click the [Planning] and [Route] buttons on the InstantAccess bar to show the [Route Plan] dialog box then click the [SAR] button.

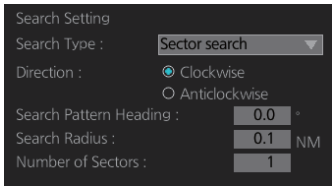
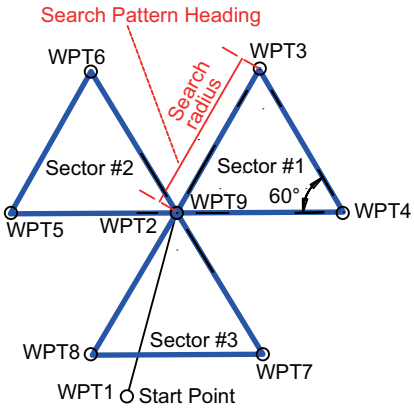


2. Enter your start point. To enter current position, click the [Ship Position] button. (The start point can also be entered directly on the screen. Put the cursor on the start point, right-click the chart to show the context-sensitive menu shown below then click [Set start point].)



3. Enter your ship's speed and turn radius, current UTC date and time.
4. At [Search Point], enter the estimated position of the object to search. (The search point can also be entered directly on the screen. Put the cursor on the search point, right-click the chart to show the context-sensitive menu shown at step 2 then click [Set search point].
5. Enter drift speed, drift direction, and the UTC date and time of the estimated position.
6. At the [Search Setting] window, choose and set the search type, referring to the table on the next page.

Search type	Options	Sample pattern
Expanding square	 **Direction**: Set the direction to start the search, Clockwise or Anticlockwise. **Search pattern heading:** See the right figure. **Start leg length:** Enter the start leg length. **Number of legs:** Enter the number of legs to use. Starting at the probable location of the target, the search vessels expand outward in concentric squares.	
Parallel tracks	 **Direction:** Select the direction to start the search, Clockwise or Anticlockwise. **Search pattern heading:** See the right figure. **Start leg length:** Enter the start leg length. **Track space:** Enter the length of the short legs in the route. **Number of legs:** Enter the number of legs to use. The parallel tracks pattern is usually the first pattern used in undertaking a search operation, since it assumes that the object to be search.	

Search type	Options	Sample pattern
Sector search	 **Direction:** Select the direction to start the search, Clockwise or Anti-clockwise. **Search pattern heading:** See the right figure. **Search radius:** Enter the search radius (in NM). **Number of sectors:** Enter the number of sectors to use. The sector search is used when the position of the body is known accurately and the search has to be done over a small area. It is normally carried out in the area, where the casualty or the object has been sighted.	

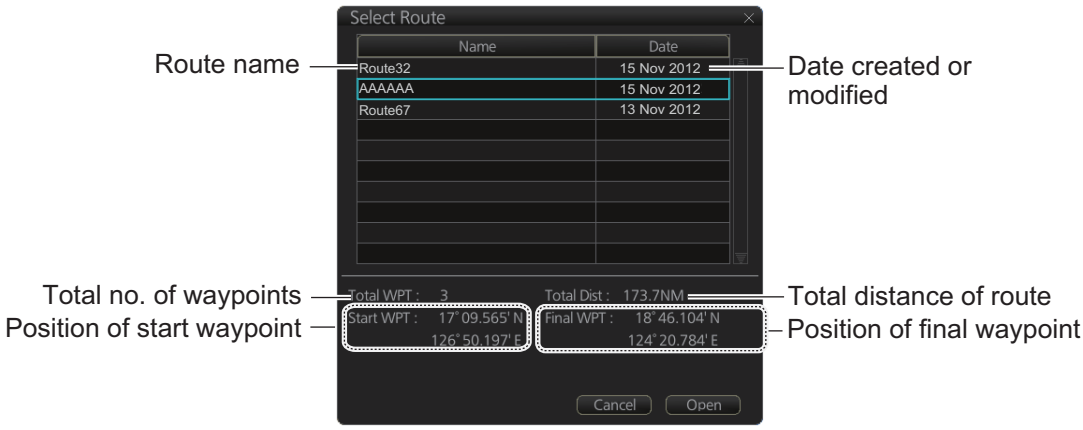
7. Click the [OK] button. The [Route Plan] dialog box appears and the system draws the search and rescue route on the screen according to the search and rescue settings.
8. To follow the route, click the [Exchange to MONIT] button.
   Note: To monitor the route the following conditions must be met:
   - The route must have at least two waypoints.
   - The route must have no impossible turns.
   - The route must have been checked.
9. To save the route, click the [Save] button and enter a name for the route, using the keyboard on the Control Unit or the software keyboard.

If necessary you can drag waypoints to new position, like with an ordinary route.

12.7 Route Bank

The route bank stores all the routes you have created. To show the route bank, do one of the following:

Voyage planning mode:	[Planning], [Route], [Route bank] in [Route Plan] dialog box
Voyage navigation mode:	[Route], [Select]
[Route Information] box:	Click route name then select [Select Route].



In the Voyage planning mode, the waypoints of a route can be inserted into the route currently selected.

1. Show the dialog box shown above.
2. Select the route for which you want to copy its waypoint(s) in the active route. For example, select Route2.

3. At [Insert Position], select where you want to insert waypoints into the active route, [Before] or [After] the waypoint selected in the next step. The [Reset] button restores the route to the original condition.
4. In the left-hand column set the cursor on the waypoint where to insert waypoints from the inactive route.
5. At the right-hand column, select the waypoint(s) to add to the active route. A context-sensitive menu is available by right-clicking [WPT] in the inactive route. The options available are [Select All], [Unselect] and [Reverse] (reverse the order of the waypoints in the inactive route).

6. Click the << button to insert the waypoint(s) from the inactive route to the active route. In the example below, WPT1 of the inactive route is inserted at the end of the active route.

7. Click the [OK] button to finish.

12.8 Route Optimization

12.8.1 Available route optimization strategies

After all waypoints are inserted, the route is optimized from the [Optimization] page in the [Route Plan] dialog box. If no optimization strategy is chosen, the optimization is done with "max. speed," defined in ship parameters. Optimization calculates all parameters for route steering (course and distance between two waypoints, maneuvering start point, WOP, etc.). There are four methods for optimization:

Max Speed: This calculation uses the maximum speed defined in the ship parameters and multiplies by all reduction factors (weather, ice, fouling, etc.) together with speed limits given for each waypoint to generate ETA. ETA may be entered, however it is calculated with user-entered ETD and speed limit.

Time Table: Calculates the speed required in order to arrive at destination at required ETA. Maximum speed is never exceeded. The user enters ETD and ETA to calculate speed to use. If, the user-entered ETA is earlier than that found with the Max. Speed calculation, the Max. speed -calculated ETA will be indicated below the Time Table ETA calculation figure. The calculated speed is shown on the Route Monitor display as "Suggested **.*kn".

Max. Profit: Based on ETD, this calculation takes in account the fuel cost and the fixed cost of the ship and calculates the most profitable speed (highest profit per time unit).

Min. Cost: Based on ETD, this calculation takes in account the fuel cost and the fixed cost of the ship and calculates the speed that gives the minimum total cost. You need to set Optimization parameters beforehand to use this feature.

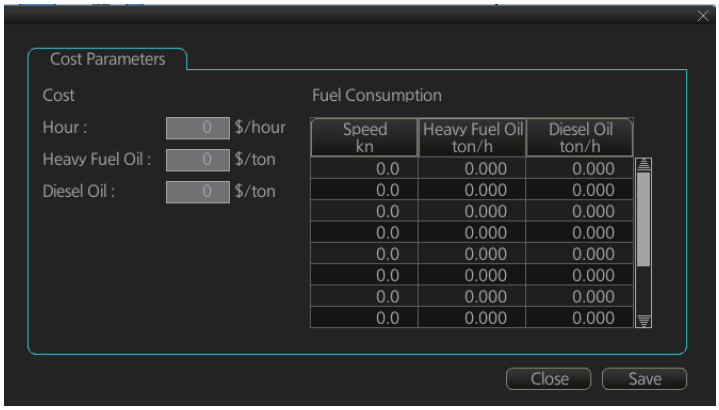
12.8.2 How to optimize a route

You can define Estimated Time of Departure (ETD), desired number of waypoints and Estimated Time of Arrival (ETA) on the [Optimization] page in the [Route Plan] dialog box to optimize your route.

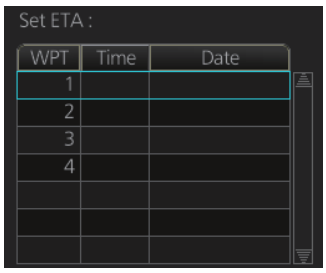
1. Click the [Optimize] tab to open the [Optimize] page.

2. At [Type], click the drop-down list to select desired optimization strategy, referring to section 12.8.1 Available route optimization strategies.
3. Do the following:
   1) At the [Set ETD] window, enter starting WPT and date and time of departure. For entry of the date, the [Date Set] window, shown right, appears. Click the applicable date in the calendar if you are going to depart during the current month, or click the applicable arrow on the month/year button to select a different date. Click the [OK] button to save the ETA and close the window.

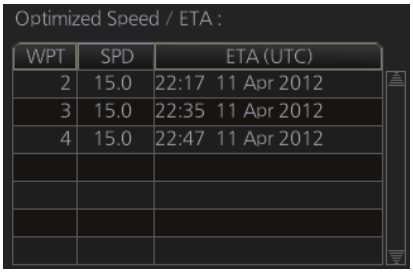
   2) At the [Parameters] window in the [Route Plan] dialog box, enter the maximum speed to use. For the Type [MAX profit], enter [Income] value.
   If necessary, click the [Edit Cost Parameters] button to enter fuel consumption values.



3) For [Time Table], the [Set ETA] window appears. Set the ETA to use for each waypoint. To enter the Time and Date, click the [Date] window to show the [Date Set] window. Click the appropriate date. The date entered appears in the [Set ETA] window.



4. Click the [Calculate] button to calculate optimal route. The [Optimized Speed/ETA] dialog box shows the results of the calculation.



5. To apply the information to the route, click the [Apply to Route] button.

12.8.3 How to plan a speed profile

A speed profile is defined by general max. speed and optimization types. These values are given while planning a route. You can define speed limit and optimize type in the [Optimize] page of the [Route Plan] dialog box and in the [Waypoints] page you can give min. and max. speed for each leg. The table below demonstrate how different optimize types and speed limits influence speed.

WPT	min speed	cost	profit	timetable	Max speed	Max speed
1	4	4.8	10.9	10.0	10	10
2	4	4.8	12.9	15.0	15	15
3	4	4.8	12.9	16.2	17	20
4	4	4.8	12.9	16.2	17	20
5	6	6.0	12.9	15.0	15	15
6	6	6.0	12.9	16.2	17	20
7	4	4.8	12.9	16.2	17	20
8	4	4.8	12.9	16.2	17	20
9	6	6.0	12.9	16.2	17	17
10	4	4.8	8.0	8.0	8	8

12.9 Reports

This chart radar generates reports for waypoints in the selected route. If connected to a printer, reports can be printed by clicking the [Print Text] button. Text in reports can be searched with the [Find] button.

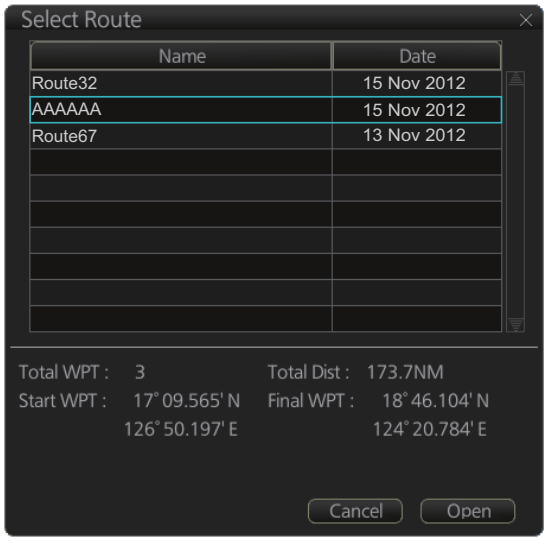
Each report commonly provides

- The name of the route
- Route comments
- The date and time of the report

To generate a report, do the following:

1. Click the [Plan] button to go to the Voyage planning mode.
2. Click the [Report] button followed by the [Route] button. Click applicable “report” button.

The following dialog box appears.

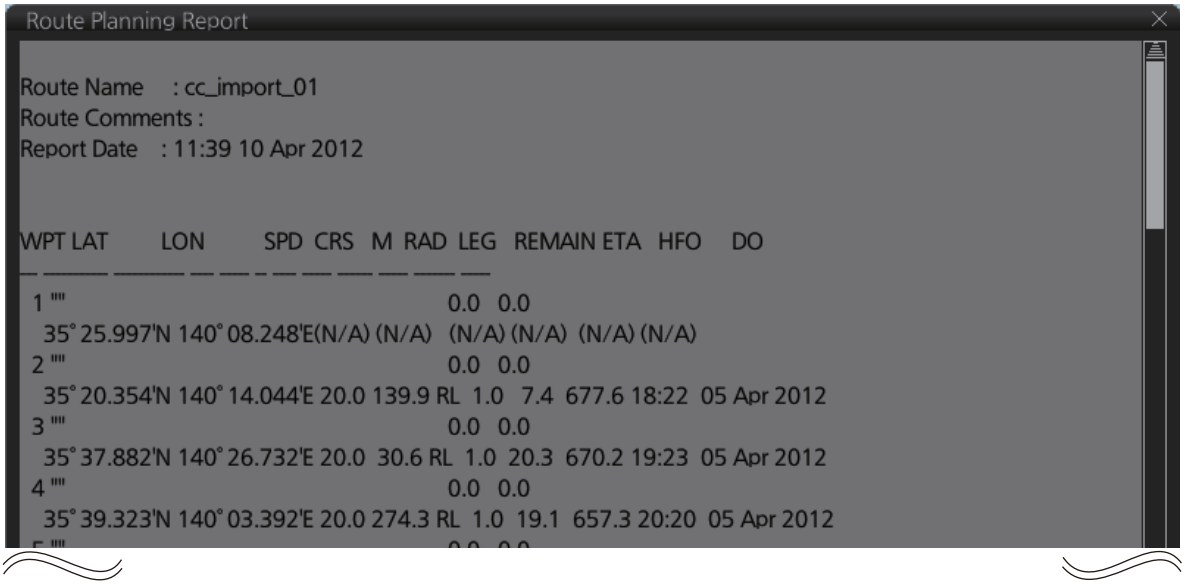


3. Select the appropriate route then click the [Open] button to show the selected report. See the next several pages for examples.

WPT table report

The WPT report contains the following information:

- Waypoint no.
- Position of waypoints
- Planned speeds
- Planned courses
- Distances between waypoints. Distance is not directly calculated from LAT and LON values of WPTs location, but the distance is shorter distance compensated for planned radius for each waypoint.
- Estimated times of arrival (ETA)
- Planned fuel consumption
- Total distance of route. Distance is not directly calculated from LAT and LON values of WPTs location, but the distance is shorter distance compensated for planned radius for each waypoint.



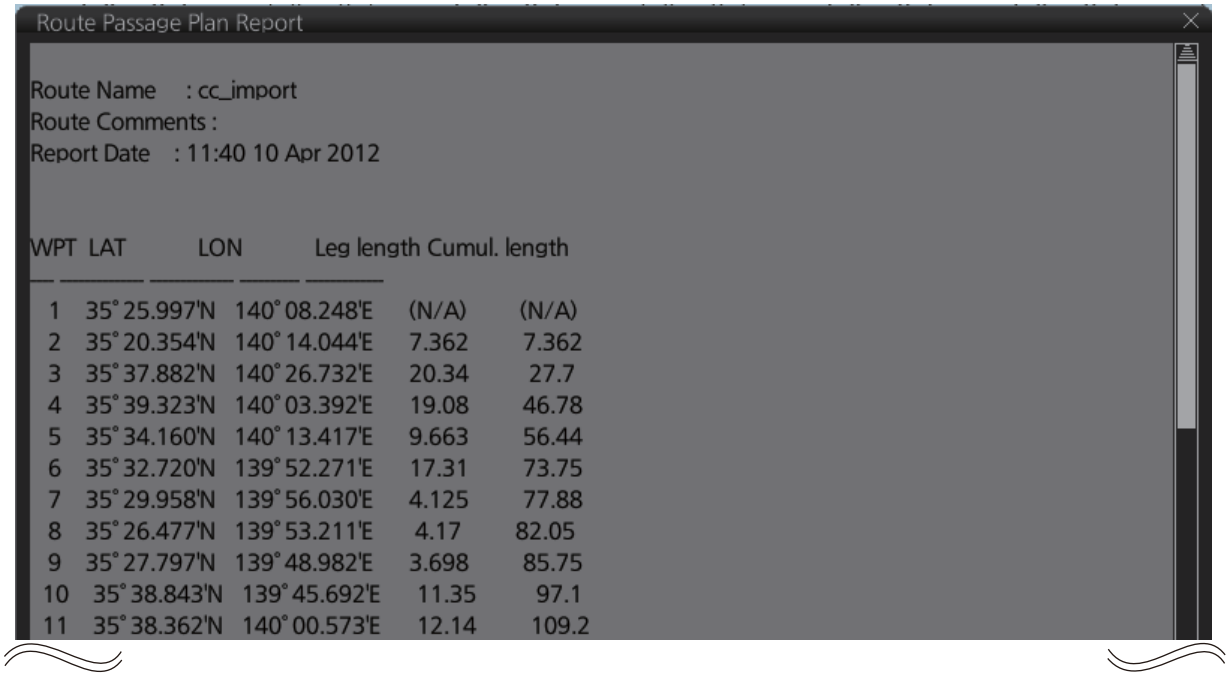
Full WPT report

You can generate a full waypoint report for the routes stored in the system.

Passage plan report

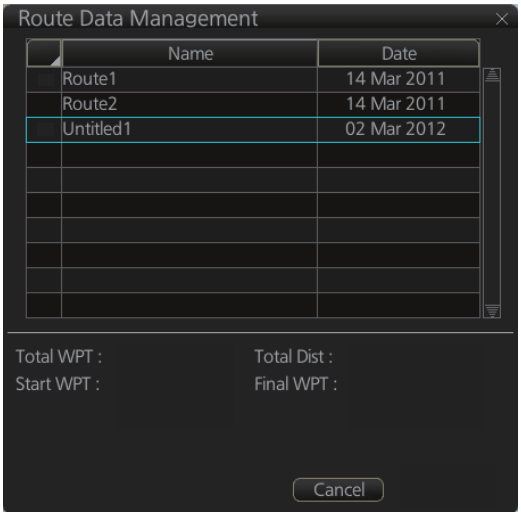
The passage plan report generates WPT report together with Notes report. The system automatically attaches Notes from the Voyage planning mode on the route plan when you choose the Passage Plan report. click the [Report] and [Passage] boxes in succession on the InstantAccess bar. To close the report viewer, click the Close button at the top-right position on the report viewer. The report may be printed by clicking the [Print Text] button.

The example below shows that a passage plan has been generated using the route plan "SOUTHAMPTON ROTTERDAM" and Notes generated for "SOUTHAMPTON ROTTERDAM".



12.10 How to Delete Routes

1. Click the [PLAN] button on the Status bar to get into the Planning navigation mode.
2. Click the [Manage Data] button on the InstantAccess bar followed by the [Route] button.



3. Put a checkmark in the check box to the left of the route name.
4. Click the [Delete] button.

13. USER CHARTS

13.1 Introduction

User charts are overlays that the user creates to indicate safety-related objects and areas. They can be displayed on both the radar display and the electronic chart. These charts are intended for pointing out safety-related items like position of important navigation marks, safe area for the ship, etc. User charts areas can be used to activate alerts and indications based on user-defined danger symbols, lines and areas. When route or own ship estimated position is going to cross a user chart symbol, line or area that is defined as a dangerous one, an alert or indication is generated by the system. See the chapter on chart alerts.

A user chart consists of points, lines and letter/number, symbols, etc. The maximum number of user chart objects available per chart is 4,000 points.

The user chart is displayed on the radar display and its position and shape is based on the ship's actual position. When own ship is moving in the area covered by the user chart, the elements of the user chart are superimposed on the radar, with max. 80 nearest elements displayed.

13.1.1 Objects of user charts

Below is a description of the objects used in a user chart.

- **Tidal**: There are two types of tidals, current and predicted.
- **Line**: You can define four different types of lines. Lines can be used in chart alert calculation and/or display on the radar:
  - **Navigation lines:** Displayed on both the radar display and the chart display. Navigation lines are reference lines for coast line.
  - **Coast line:** Displayed on both the radar and the chart display. Coastal line is usually a well-defined (by chart digitizer) multi-segment line showing the coastline. The user is able to create this type of line in case there is no suitable chart available over desired area in S57 format.
  - **Depth contour:** Displayed on both the radar and chart display. Depth line shows the chosen depth levels. The user is able to create this type of line in case there is no suitable chart available over desired area in or S57 format.
  - **Route line:** Displayed on both the radar display and the chart display. Route lines are zones for anchoring, traffic separation lines, etc.
- **Clearing line**: A clearing line is used to define a line which a vessel can sail to avoid navigational hazards. A clearing line can be of the NMT (Not More Than) or NLT (Not Less Than) type. Displayed on the chart display only.
- **Area:** The operator can define closed areas, which the system can use to detect safe water areas. If route or estimated ship position is going to cross the area, the system generates a warning to the user. These areas can be used to specify safe areas as defined by the master or by the policy of the ship's owner. They are always available regardless of the type of chart material used.

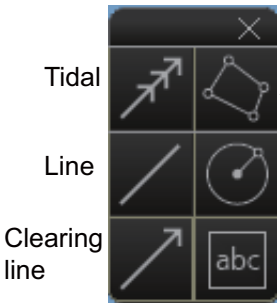
- **Circle:** The operator can define an area with a circle, which can define a location to avoid. If route or estimated ship position is going to cross the area, the system generates a warning to the user. These areas can be used to specify safe areas as defined by the master or by the policy of the ship's owner. They are always available regardless of the type of chart material used.
- **Labels:** There are two types of labels: point and label. A "point" (i) is mainly used to denote position of objects, such as buoys, light houses, fixed targets, wrecks, etc. Points can be used in chart alert calculation. A "label" provides user-entered text to show on the display.

13.2 How to Create a User Chart

You can create and modify a user chart in the Voyage planning mode.

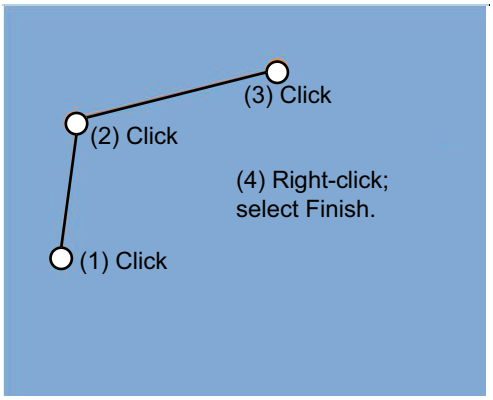
To make a complete user chart, do the following:

1. Click the [PLAN] button on the Status bar to go to the Voyage planning mode.
2. Click the [Planning] and [User Chart] buttons on the InstantAccess bar to show the user chart palette and the [User Chart] dialog box.

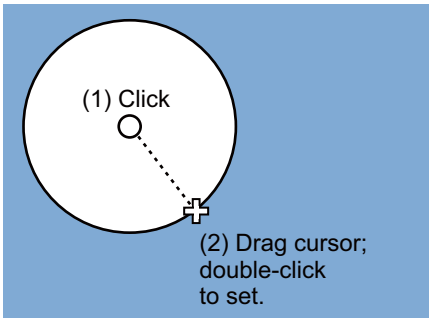


3. Click the [New] button on the [User Chart] dialog box to create a new chart.
4. Click the desired object (button) on the palette.The [Tidal], [Line], [Clearing line] and [Label] buttons have multiple choices. Right-click the respective button to show a context sensitive menu. The choices available for each object are shown below.
   Tidal: Current, Predicted
   Line: Coast, Nav, Route, Depth
   Clearing line: NMT (Not More Than), NLT (Not Less Than)
   Label: Point, Label
5. Put the cursor on the location to insert the object then push the left button. See the figure below for how to construct lines, areas and circles. For the “Tidal” object,

you can set Orientation, Strength and Time from the dialog box. With the “Label” object you can enter text and show that text on the screen.

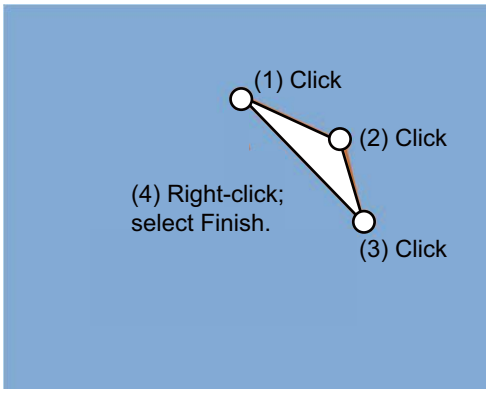


How to create a line



1) Put cursor where to locate center of circle then click.
2) Drag cursor to set radius; double-click to set.

How to create a circle

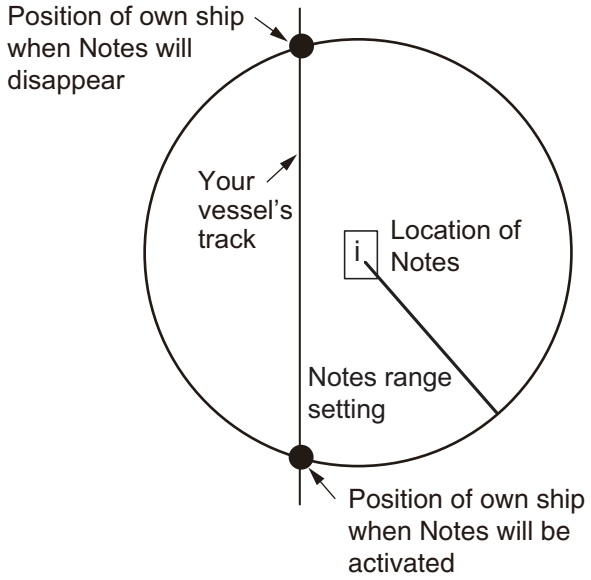


How to create an area

6. When you insert an object, the following is done in the [User Chart] dialog box:
   - Name of the object button appears in the [Object] window
   - Latitude and longitude position of the object is displayed
   - Total object count is updated
7. To enter a name for the object click the appropriate location in the [Name] window then use the scrollwheel or numeric keys on the Control Unit to enter a name.
8. To show the object on the radar display, click the corresponding box in the [Radar] window to show a checkmark in the box.
   For the label, line, clearing line, area and circle, click the corresponding box in the [Danger] window to use or don't use the object in chart alert calculation. Show a red checkmark to use the object in chart alert calculation.
   For the area, circle and line, you can add Notes as shown below. See the description and figure below for a description of Notes.
   1) Enter the text for the Notes in the [Description] box.
   2) Click the box in the [Notes] window of the [User Chart] dialog box to show a checkmark.
   3) At the [Range of notes] input box, enter the distance from the Notes position at which to display the Notes.
      Note: You cannot select both Danger and Notes for these symbols; select either Danger or Notes.

What are Notes?

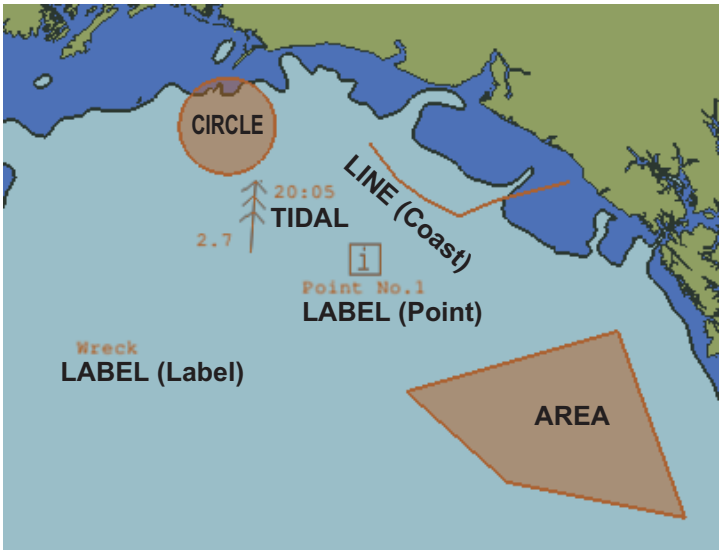
"Notes" provides messages for the operator relative to your vessel's position in the Voyage navigation mode. The system compares Notes position and when own ship is x miles from the Notes it generates a message.



9. To continue entering the same symbol, click a new location on the screen and do step 3. To enter a different symbol, do steps 3 and 4.
10. After you have entered all necessary objects, click the [Save] button.
    Note: If the [Save] button is not shown, update the user chart to show the button.
11. The [Save as user chart window] appears. Enter a name for the user chart then click the [Save] button.

The figure on the next page shows a user chart and the corresponding entries in the [User Chart] dialog box.

- The Line with the name "Coast" is a coastline.
- The Circle has the Notes "Arrival No.1," which means the message "Arrival No.1" will be shown on the screen when the ship is 1 NM from the position of the center of the circle.
- The Tidal marks line marks a tidal (current).
- The Area has Radar and Danger checked. This means the area is shown on the radar display and is used in chart alert calculation.
- The Label with the name "Point No. 1" is a point label and is also shown on the radar display.
- The Label with the name "Wreck" is a common label and has Danger checked; it is used in chart alert calculation.



Note: The following combinations of object and display are not allowed:
- Tidal object with Radar, Danger, Notes
- Clearing line with Radar, Notes
- Label with Notes

How to use the Undo feature

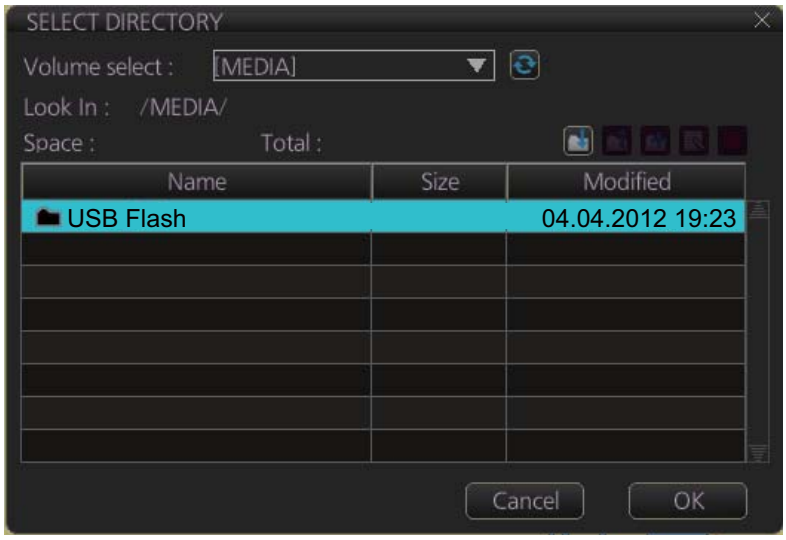
The Undo feature, available when creating a route and a user chart, can be accessed from the [Undo] button on the InstantAccess bar, use double-click, or the context-sensitive menu. In user chart creation the feature is used with object and text input as follows:

Tidal, Circle, Current, Label: Delete last-entered object.
Area, Line: Erase last-entered point. For [Area], the area must have at least four points. And for a [Line], there must be at least three points.
Text input: Erase last-entered character or character string.

13.3 How to Import a User Chart Created with ECDIS FEA-2x07

User charts created at the ECDIS FEA-2x07 can easily be imported to this ECDIS. Copy the user charts to a folder (see chapter 17 in the operator's manual of the FEA-2x07) in a USB flash memory then do as follows:

1. Set the USB flash memory to the USB port on the Control Unit.
2. Activate the Voyage planning mode.
3. Click the [Manage Data], [Data Import] and [User Chart] buttons to show the [SELECT DIRECTORY] dialog box.



4. Select the folder that contains the user chart(s) to be imported then click the [OK] button.

5. Check the user chart(s) to import then click the [Import] button.

13.4 How to Edit Objects on a User Chart

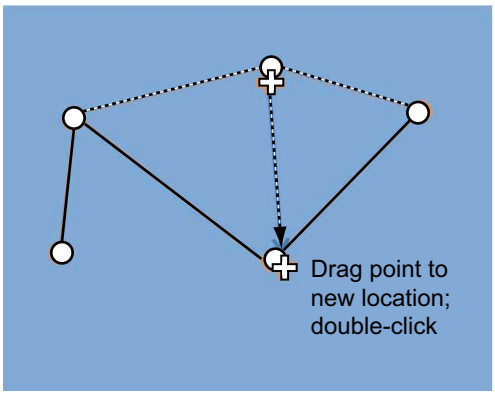
Do steps 1 and 2 in section 13.2 to show the [User Chart] dialog box then click the [Select] button. Select the user chart to edit then click the [Open] button. Follow the appropriate instructions below.

13.4.1 How to edit objects on the chart area

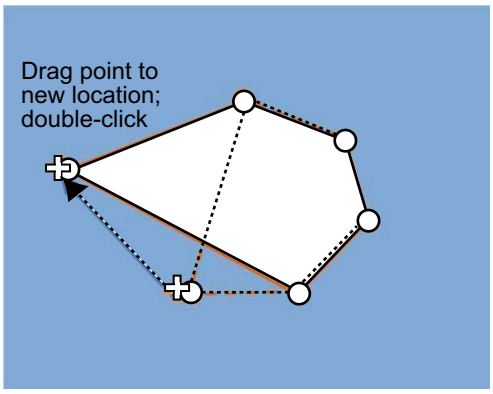
How to move objects

Drag and drop the object.

How to change corner points in lines and areas



How to change corner point on a line



How to change corner point in an area

How to insert a corner point on a line or area

Put the cursor on the location where to insert a corner point, right-click to show the context-sensitive menu then select [Insert].

13.4.2 How to edit objects from the User Chart dialog box

The latitude and longitude position, object name and description of an object can be edited from the [User Chart] dialog box. Open the user chart as described in this section. Double click the item to edit and use the scrollwheel to edit.

13.5 How to Delete Objects from a User Chart

How to delete an object

Right-click the object to show the context-sensitive menu and select [Delete].

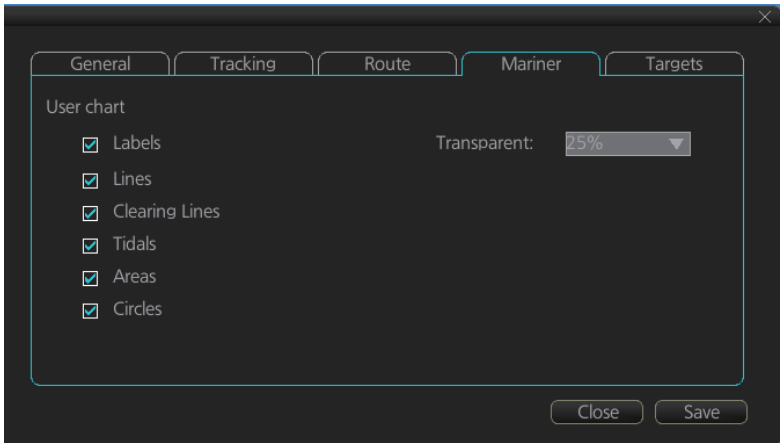
How to delete a point on a line

Put the cursor on the point to delete then right-click to show the context-sensitive menu. Select [Delete Point]. The line is redrawn.

13.6 How to Select the User Chart Objects to Display

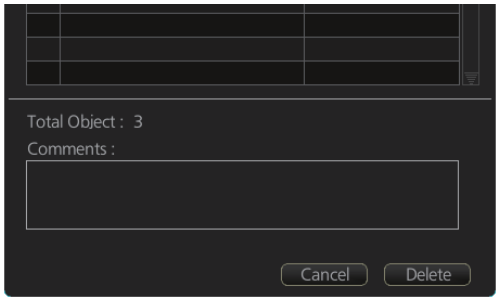
User charts can be displayed on the electronic chart. Open the [Mariner] page in the [Symbol Display] menu and check the user chart items to display. Choose the degree of transparency for the objects with [Transparent].

Note: Alpha blending technology is used for transparency effects.



13.7 How to Delete User Charts

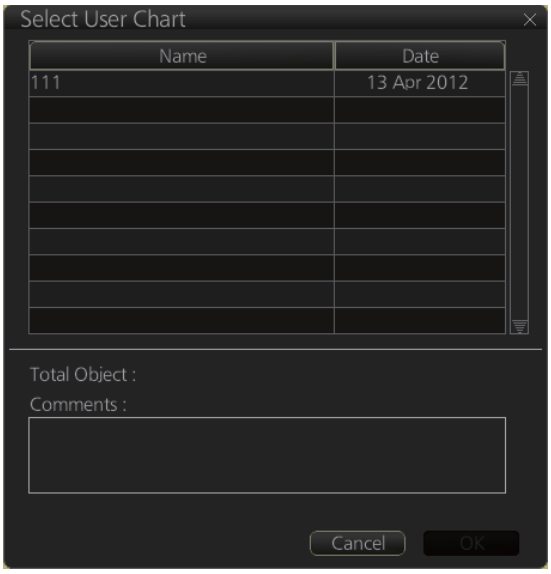
1. Click the [PLAN] button on the Status bar to get into the Planning navigation mode.
2. Click the [Manage Data] button on the InstantAccess bar followed by the [User Chart] button.



3. Check the user chart(s) to delete.
4. Click the [Delete] button.

13.8 User Chart Reports

1. Click the [Plan] button to go to the Voyage planning mode.
2. Click the [Report] button followed by the [User Chart] button to show the S[elect User Chart] dialog box.



3. Select the appropriate route then click the [Open] button to show the selected report. See the next several pages for examples of reports.

Full report

The full report contains information about each tidal, line, clearing line, label, area and circle in the user chart selected. Check or uncheck the boxes at the top of the display to select the report(s) to display.

Tidal report

A tidal report provides

- Position of the tidal
- Type of tidal (current or predicted)
- Speed and direction of the tidal
- Time of the tidal

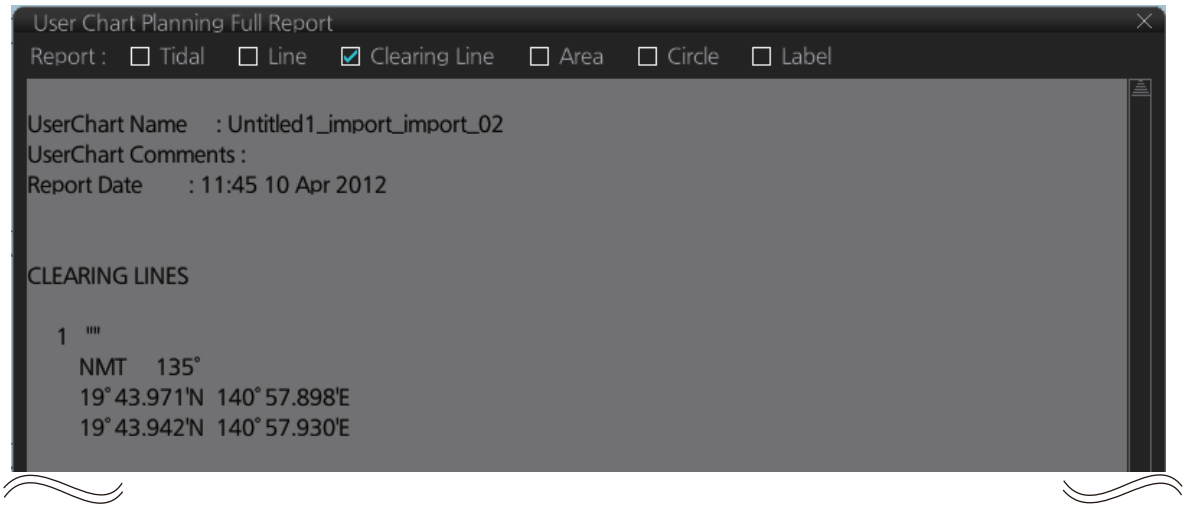
Line report

A line report provides

- Line name
- Latitude and longitude position of each point on the line

Clearing line

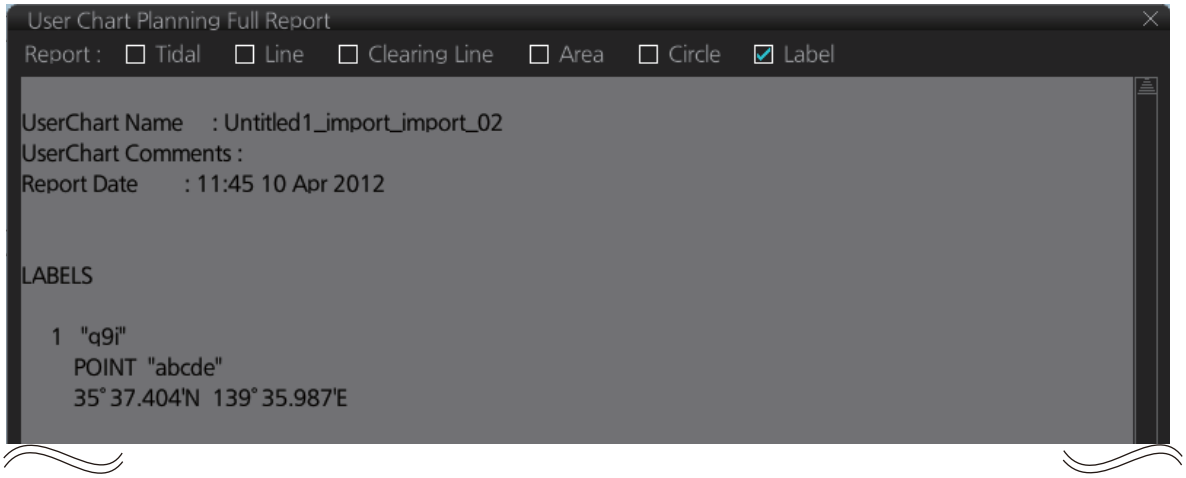
The Clearing line report shows the name and position of clearing lines entered on the chosen user chart selected.



Label report

A label report provides

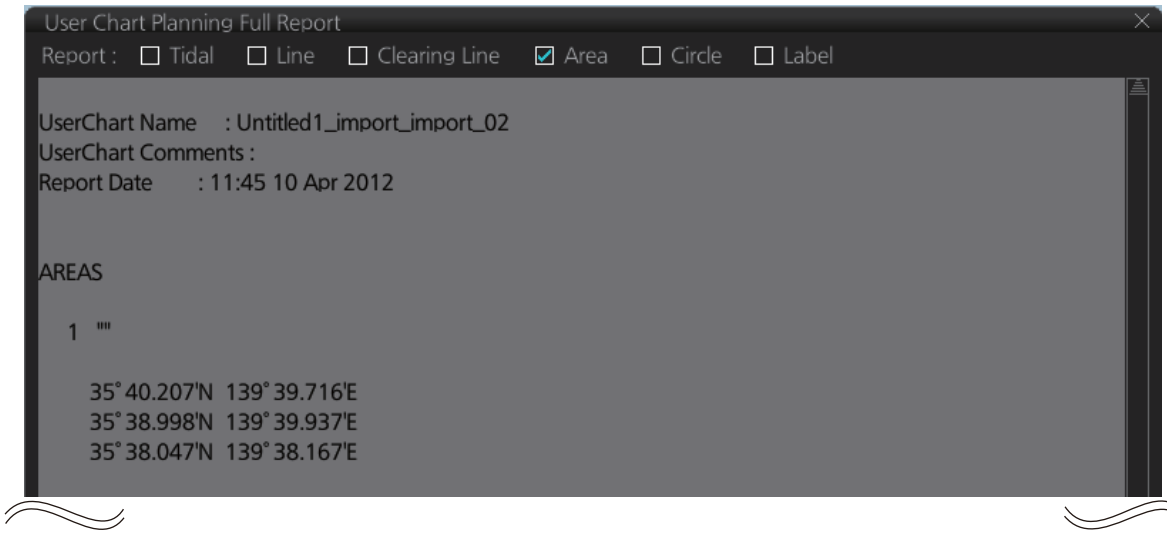
- Latitude and longitude position of each label
- Name of each label
- “On radar" is shown if the label is shown on the radar display.



Area report

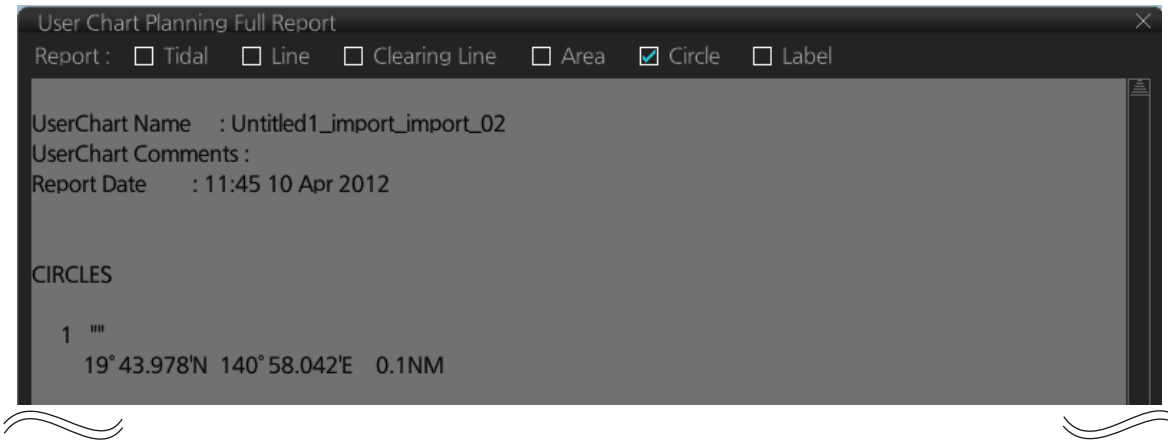
An area report provides

- Area no. and area name
- The latitude and longitude position of each point of the area
- The description of the area (in the example below is it "Danger")
- "On radar" is shown if the area is shown on the radar display.



Circle report

The circle report provides the position and radius of circles drawn on a user chart.



14. HOW TO MONITOR ROUTES

Route monitor is a means for permanent monitoring of the ship's behavior relative to the monitored route. The [Route Information] box displays the data on the ship's position relative to the monitored route. The monitored route consists of the following information, displayed in the electronic chart area:

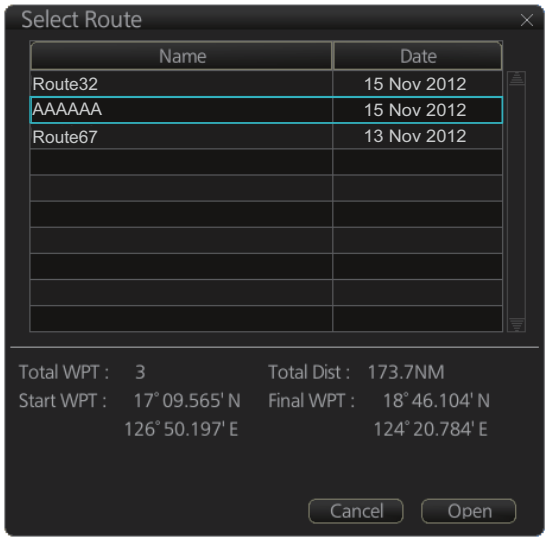
- The route is displayed with red dots.
- The limits of channels of each leg are displayed with solid red lines. These limits are used to detect chart alerts when you are monitoring the route. See chapter 11 for how set those limits.
- Each leg has information about planned speed, shown inside a rectangle.
- Each leg has information about planned course to steer.

Note: In order to display charts with correctly updated situation, always use current date as Approved until and Display date during your voyage. If your voyage lasts more than one week, set current date at least once per week during your voyage. See section 9.3 for how to set those dates.

14.1 How to Select the Route to Monitor

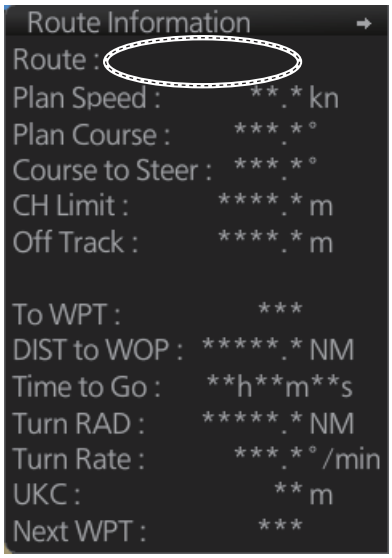
Method 1: InstantAccess bar

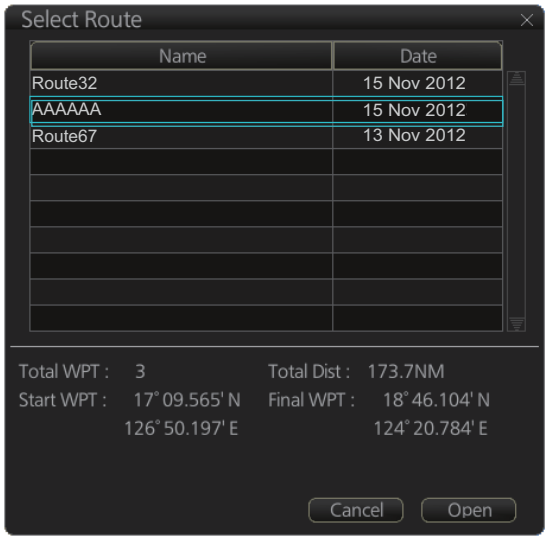
In the Voyage navigation mode, click the [Route] and [Select] buttons on the InstantAccess bar. Click a route then click the [Open] button.

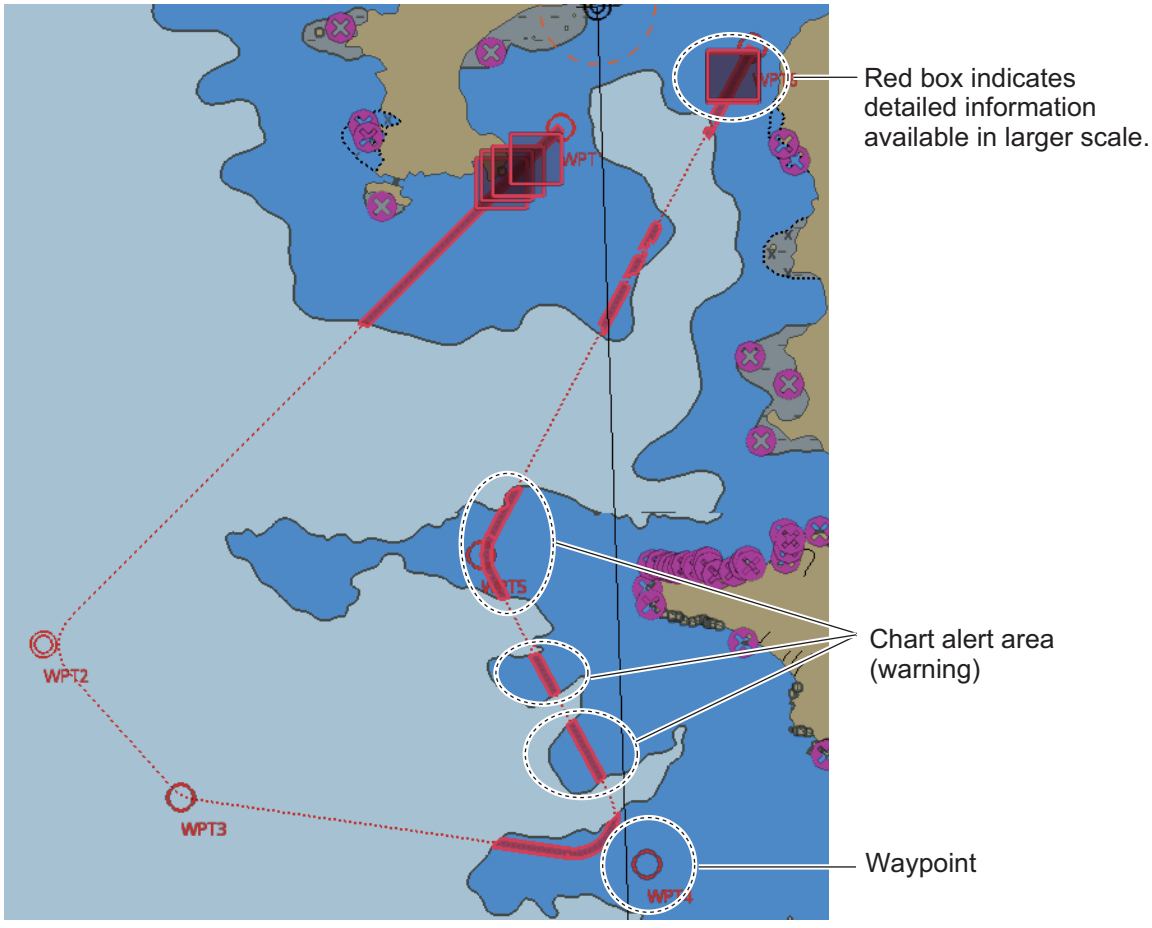


Method 2: Selection from the Route information box

Right-click the route name location in the [Route information] box then select [Select Route] to show the [Select Route] dialog box. Select a route then click the [Open] button.

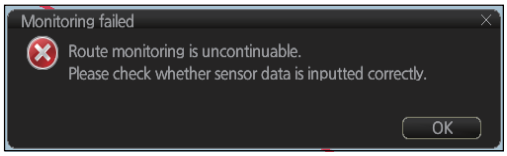






About monitoring routes

- When you choose a route for monitoring, the messages shown below appear, on the [Select Route] dialog box or in a message window, when a route cannot be opened for monitoring.
  - "Impossible turn at waypoint XX" (XX=waypoint no.). Geometry of the route makes it impossible for the ship to accomplish a turn. Modify the route to make the turn possible.
  - "Unchecked / Check condition differs". The route has not been checked. Check the route, on the [Alert Parameters] page.
  - "Monitored in the NAVI mode". The route is currently being monitored.
  - "More than one WPT needed". The route has only one waypoint. Add more waypoints to the route.
  - "Route monitoring cannot be started. Please check ship's position and conditions." Click the [OK] button to close the message. Check ship's position and conditions of the route.
- If you have small-scale chart(s) on display that have the whole eastern/western (0-180°E/0-180°W) hemisphere and a part of the other hemisphere on display, there is a limitation to display a route. To avoid this, set chart center so that the whole eastern/western hemisphere is not on the screen.
- Six routes, one active and five plan, can be shown simultaneously in the Voyage navigation mode.
- If, in the radar mode, route monitoring is stopped, the alert 691 "RM Stop - Exceed Max XTE", 692 "RM Stop - Disconnect Sensors", or 693 "RM Stop - Other Causes" appears. If this occurs, switch to the Chart for Radar mode. The pop-up shown below appears. Click the OK button. Find the reason why route monitoring was stopped and then restart route monitoring.



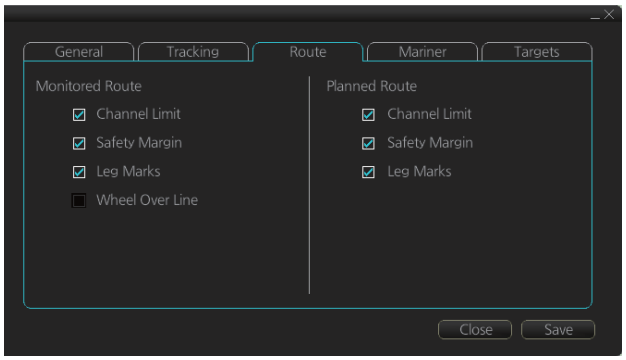
- Route monitoring is stopped and an alert is displayed when the GPS position is lost. Restore GPS position then restart route monitoring.

14.2 How to Stop Monitoring a Route

In the Voyage navigation mode, click the [Route] and [Unselect] buttons.

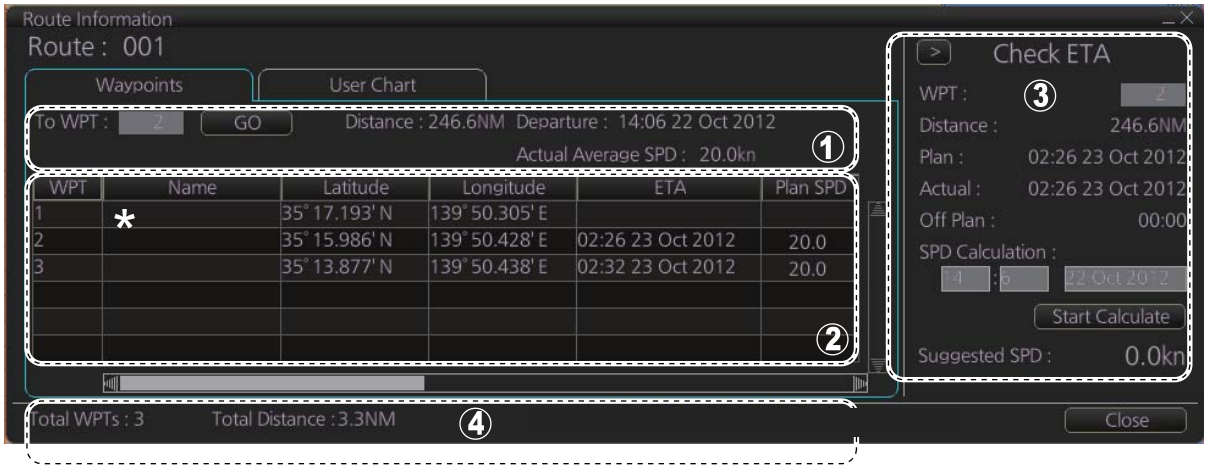
14.3 How to Select What Parts of a Route to Display

You can specify what parts of the monitored route to display. Click the [DISP], [SET] and [Symbol DISP] buttons on the InstantAccess bar.



14.4 How to View Waypoint Information

Click the [Route] and [Route INFO] buttons on the InstantAccess bar to show the [Route Information] dialog box. Click the [Waypoints] tab.



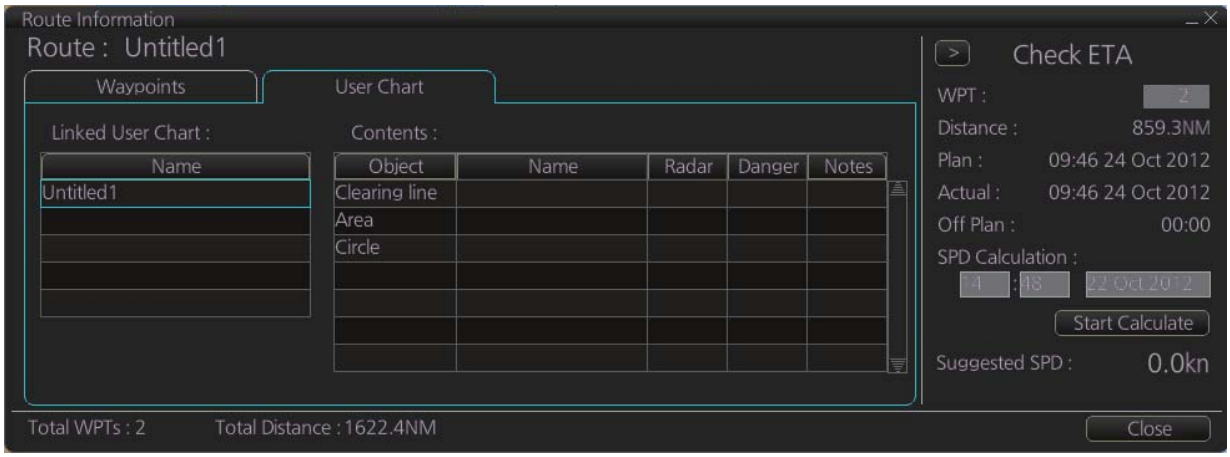
* Scroll list horizontally to view

WPT	Leg/°	Leg/NM	STR mode	RAD/NM	CH limit/m	SPD MAX	Margin/m
1							
2	154.0	3.6	Rhumbline	1.00	185	22.1	40
3	151.0	2.5	Rhumbline	1.00	185	22.1	40
4	161.1	3.0	Rhumbline	1.00	185	22.1	40
5	241.6	3.0	Rhumbline	1.00	185	22.1	40
6	321.5	5.2	Rhumbline	1.00	185	22.1	40

No.	Item	Description
1	**To WPT, GO button**	The system chooses a next waypoint automatically. Check that the To waypoint is the desired one. The system will automatically advance to a next waypoint when you pass the To waypoint. The default To WPT is WPT1. If you desire a different one, select it here and the click the [GO] button.
	Distance	Distance from current position to selected waypoint.
	Departure	The time the route was selected for monitoring.
	Actual Average SPD	Actual speed
2	**Waypoint list**	The waypoint list provides for each waypoint WPT no., name, latitude and longitude position, ETA, plan speed, bearing and distance to leg, steering mode (rhumb line or great circle), radius, channel limit, speed max, and margin.
3	**Check ETA window**	Parameters for checking ETA. The arrow to the left of [Check ETA] collapse or display the [Waypoints] and [User Chart] tabs.
	WPT, Distance	Select a WPT to find the distance to that waypoint from current position.
	Plan	The planned ETA to the selected waypoint.
	Actual	The actual ETA to the selected waypoint.
	Off Plan	The time difference between planned ETA and calculated ETA to final WPT, when different. The indication is prefixed with "-" if earlier than planned; "+" if later than planned.
	SPD Calculate	Enter speed and ETA (time and date) to find the speed to use to arrive by the ETA.
	Suggested SPD	The system calculates suggested speed so that ETA to the final WPT would be same as planned ETA if type of optimization was "Time table"..
	Start Calculate	Click to start calculation. The button label changes to [Stop Calculate].
4	**Total WPTs**	The total number of waypoints in the route.
	Total Distance	The total distance of the route.

14.5 How to View User Chart Information

In the Voyage navigation mode, click the [Route] and [Select] buttons on the InstantAccess bar then click the [User Chart] tab.



The [Linked User Chart] list shows all the user charts linked with the monitored route and their contents. Click a user chart name to show the contents of the chart in the [Contents] window. Items with a checkmark are activated. For the [Check ETA] window, see the preceding page.

14.6 How to Monitor a Route

You can monitor the route from the [Route Information] box. See section 6.1.6.

14.7 How to Change Monitored Route to Planned Route

The monitored route can be transferred to the Voyage planning mode. This is useful when you don't need the route for monitoring but want to edit it. To transfer the monitored route, click the [Route] and [Move to Plan] buttons on the InstantAccess bar.

Up to five planned routes can be shown on the display. If you try to display another route, the route list appears. Deselect a route in order to transfer the monitored route to the Voyage planning mode.

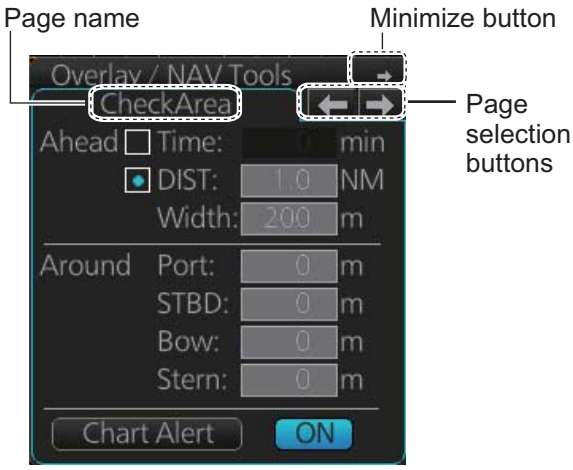
15. NAV TOOLS

The Nav tools are a suite of tools that facilitate various navigation functions. These are

- TT/AIS (see chapters 3 and 4)
- Parallel index lines
- Check area
- Range rings
- Predictor
- Anchor watch
- Under keel clearance

15.1 How to Access the Nav Tools

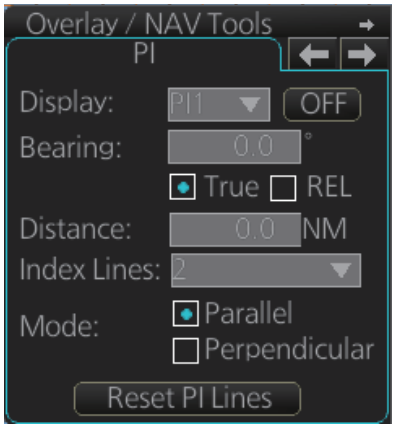
The [Overlay/NAV Tools] box is located at bottom-right position on the screen. Use the page selection buttons to select desired page.



Overlay/NAV Tools box (Check Area page)

15.2 Parallel Index (PI) Lines

The parallel index lines are useful for keeping a constant distance between own ship and a coastline or a partner ship when navigating. Up to six sets of PI lines are available and as many as six can be shown. One, two, three or six lines can be shown. (The actual number of lines shown depends on the line interval.)



The bearing can be set two ways: with the scrollwheel or dragging the PI line on the screen. The scrollwheel does not operate cyclically - it cannot cycle beyond 359.9°.

15.2.1 How to activate, deactivate PI lines

Select the PI line set to activate or deactivate with the [Display] drop-down list. Activate or deactivate the set selected with the [ON/OFF] button. Only one set can be shown.

15.2.2 PI line bearing reference

PI line bearing reference may be relative to own ship's heading (Relative) or referenced to North (True). Select [True] or [REL] as applicable.

15.2.3 Number of PI lines to display

The maximum number of PI lines to display may be selected from 1, 2, 3 or 6 lines as below. The actual number of lines visible may be less depending on line interval. Select the number of lines to display at [Index Lines].

15.2.4 PI line mode

The PI line mode can be set for parallel (0-degrees) or perpendicular (90-degrees). Select [Parallel] or [Perpendicular] at [Mode].

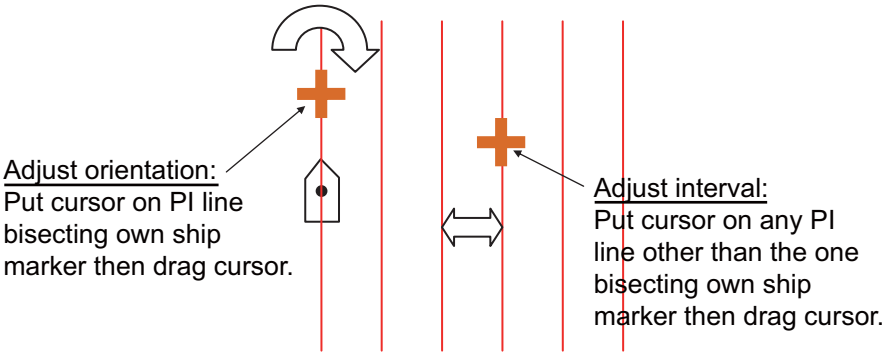
15.2.5 How to adjust PI line orientation, PI line interval

There are two ways to adjust PI line orientation and PI line interval: through the menu and on the screen.

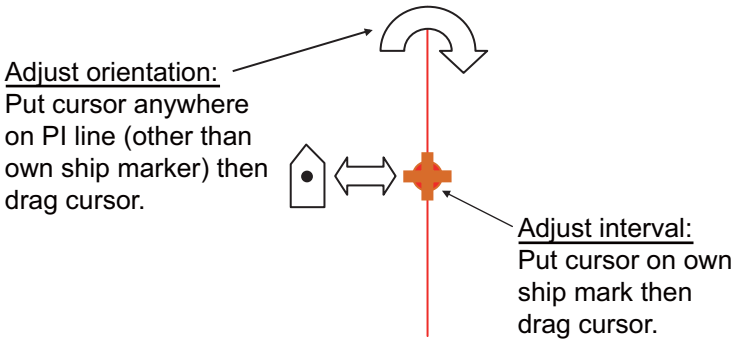
How to adjust PI line orientation, PI line interval from the menu

1. Set the orientation with [Bearing].
2. Set the line interval with [Distance].

How to adjust PI line orientation, PI line interval on the screen



How to adjust orientation and interval, multiple PI lines



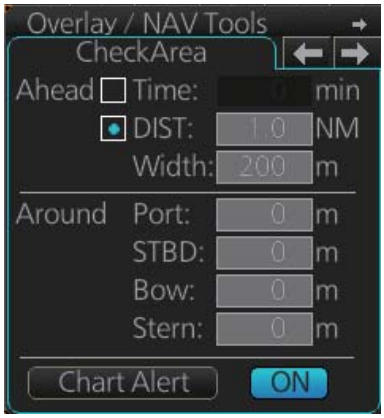
How to adjust orientation and interval, single PI line

15.2.6 How to reset the PI lines

You can automatically return PI lines to default orientation, 0-degrees for parallel orientation, 90-degrees for perpendicular orientation. This is faster than doing it manually. Click the [Reset PI Lines] button to reset the parallel lines.

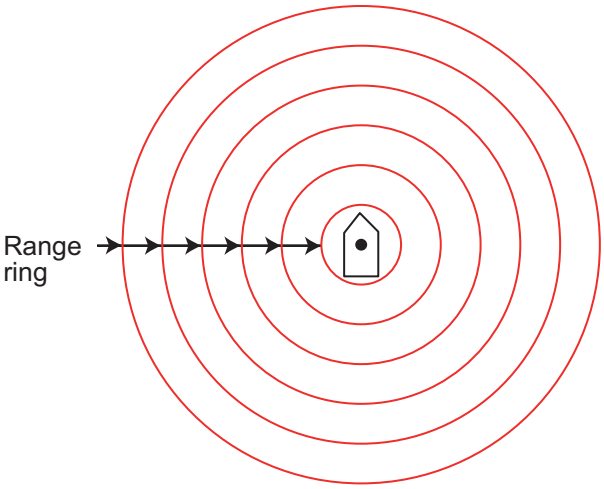
15.3 Check Area

Check area sets the area ahead and around own ship for which to check for safe navigation. See section 11.2 for how to activate own ship check.



15.4 Ring

The range rings are the concentric set of rings on the chart display. They provide an estimation of the range to an object. You can turn them on or off from the [Ring] page. The intervals are 0.025 NM, 0.05 NM, 0.1 NM, 0.25 NM, 0.5 NM, 1.0 NM, 2.0 NM, 4.0 NM, 8.0 NM, 16.0 NM, 20.0 NM.



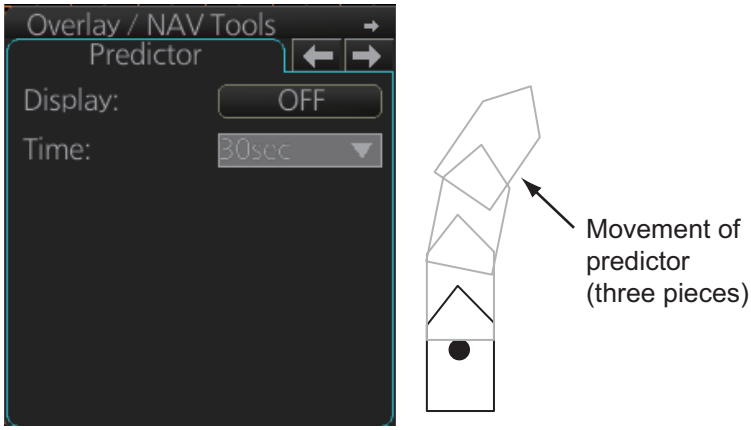
15.5 Predictor

The predictor is a tool for estimating your ship's future positions and behavior. The on-screen predictor graphic consists of three pieces of your ship, drawn in true scale to successive future positions. The position of the third symbol will be your approximate position at the end of the time interval selected. The predictor is calculated using current speed and rate of turn. Docking speed components (transversal bow speed, transversal stern speed, transversal center speed and rate of turn) are assumed to be stable during the prediction period:

- Docking speed components:
- Transversal bow speed
- Transversal stern speed
- Longitudinal center speed
- Rate of turn

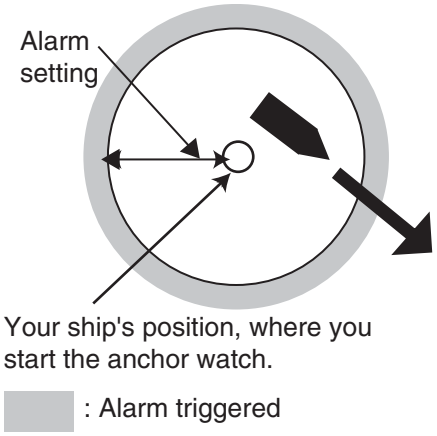
These components are assumed to be stable during the prediction period.

The predictor can be used in every steering-state, including manual steering.



15.6 Anchor Watch

The anchor watch feature checks to see if your ship is drifting when it should be at rest.



To set the anchor watch:

1. Select the [Anchor Watch] page.
2. Set the alarm radius (in nautical miles) with [Drag Circle].
3. Drop the anchor then click the [Drop Anchor] button.
4. Click the [Start Anchor Watch] button to start the anchor watch.

If your vessel travels more than the distance set here, the corresponding caution is generated.

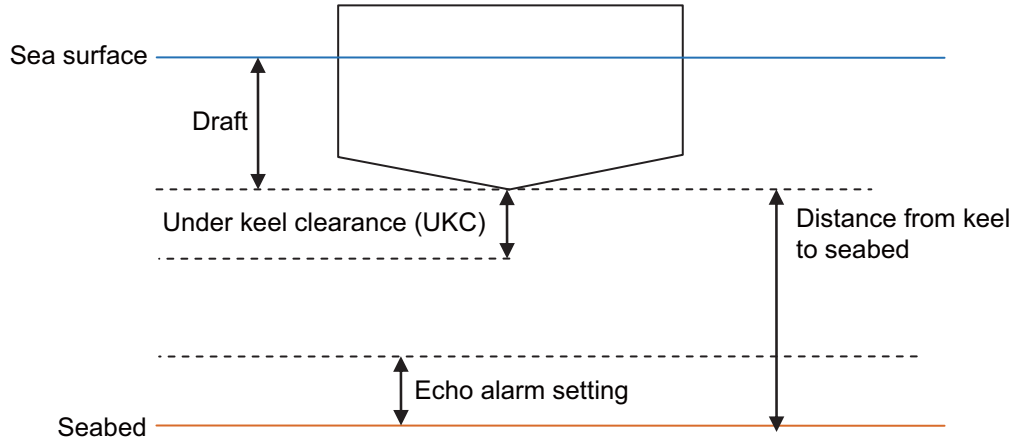
To continue to use the anchor watch, click the [Clear Anchor] button to set the alarm about your current position. To stop the anchor watch, click the [Stop Anchor Watch] button. The caution is not generated even if your ship drifts more than the distance set with [Drag Circle].

If your ship drifts more than the anchor watch setting, the Alert 495 “Anchor Watch Setting” appears.

15.7 UKC (Under Keel Clearance)

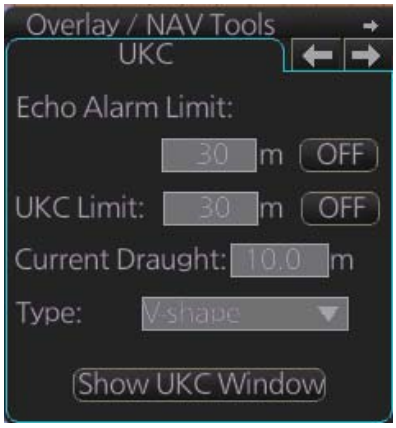
15.7.1 UKC overview

The UKC is the distance between the deepest point of the vessel's hull and the seabed. The UKC feature continuously checks ship's draft setting (UKC), and actual depth. When the depth gets shallower than the UKC, the Alert 634 "UKC Limit" is generated. And if the current depth is less than the echo alarm setting the echo alarm also is generated. Depth data is required to use the UKC function.



Note: The sensor value shown is the depth to the transducer. Convert the value to the distance to the keel.

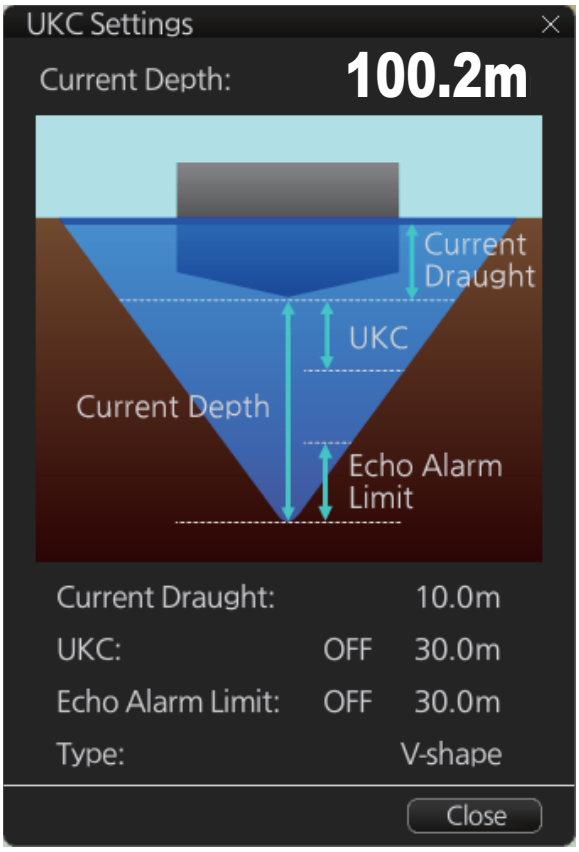
15.7.2 How to set UKC



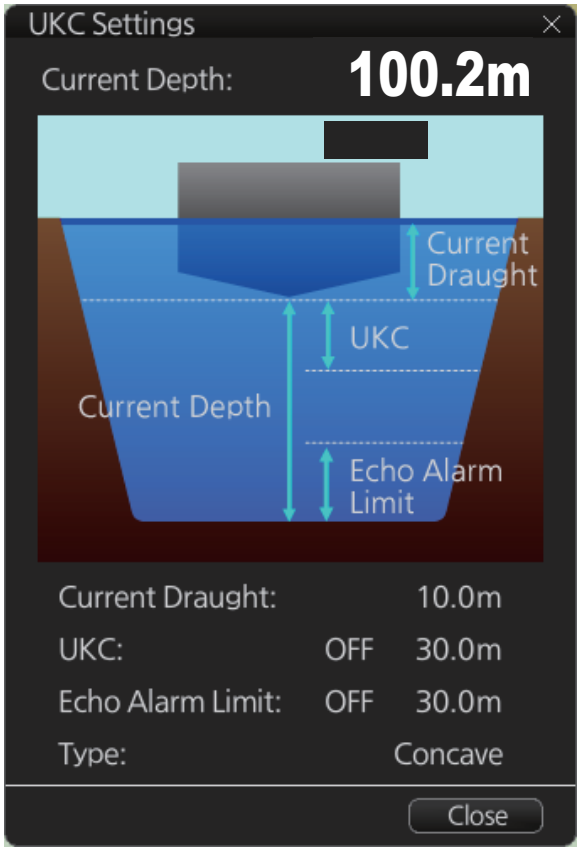
1. Select the [UKC] page from the [Overlay/NAV Tools] box.
2. Use [Echo Alarm Limit] to set the distance for the echo alarm. To activate the alarm, click the [ON/OFF] button to show [ON].
3. At [UKC Limit], set ship's UKC limit. To activate the UKC feature, click the [ON/OFF] button to show [ON].
4. Use [Current Draught] to set your ship's draft. Be sure to change the setting whenever the draft changes.
5. Use [Type] to set the shape of your ship's hull to show on the [UKC] window, [V-shape] or [Concave]. See the figure on the next page.

15.7.3 UKC window

The UKC window provides a visual graphic of the relationship between UKC, draft and current depth. The window can be shown or hidden as desired and located anywhere within the electronic chart area. To show the window, click [Show UKC Window] on the [UKC] page. To move the window, drag and drop.



V-shape hull presentation

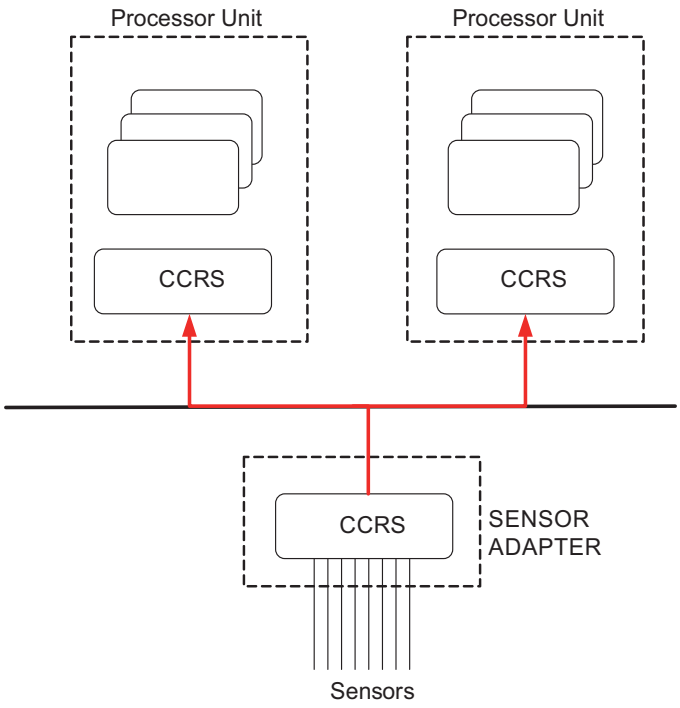


Concave hull presentation

16. NAVIGATION SENSORS

16.1 CCRS

This chart radar employs a Consistent Common Reference System (CCRS) for the acquisition, processing, storage and distribution of sensor information. The CCRS ensures that all parts of the system uses the same source and values, e.g., speed through water, heading, etc. The illustration below shows the CCRS diagram.



The CCRS process NMEA0183 and IEC 61162-1 sentences. No other types of data (video signals, etc.) are processed.

Check for validity, legitimacy

The system checks received sentences for validity and legitimacy.

Validity check: A sentences's checksum, status (A/V), Mode indicator and setting values are checked. (If checksum error is found, the sentence is disaffirmed.
Legitimacy check: The range and accuracy of a sentence is checked.)

If the check for both is OK a valid flag results. If either is invalid, the invalid flag is given.

Types of CCRS

There are two types of CCRS: System and Local. The System CCRS integrates all navigation devices. In the Local CCRS each navigation device operates independently.

Representative sensors

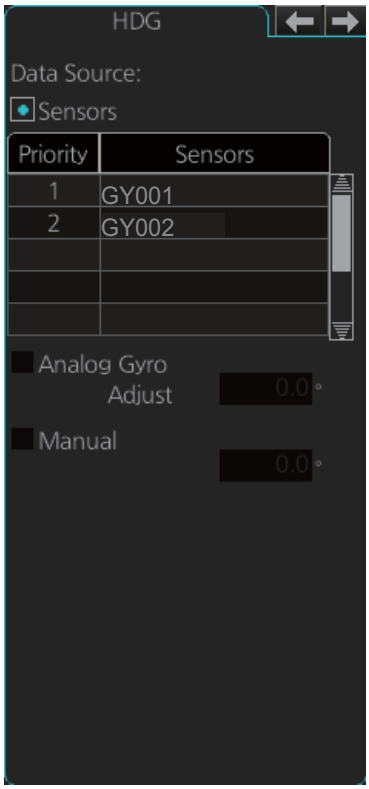
If the system has multiple like sensors, the CCRS selects the representative sensor. Generally, the system uses common representative sensors; however, independent representative sensors (local representative sensors) can also be used.

16.2 How to Select Navigation Sensors

The operator can choose navigation sensors to use for navigation and view their current values on the applicable page in the [System Sensor Settings] and [Local Sensor Settings] menus. To access these menus, right-click the [Sensor information] box then click [Settings].

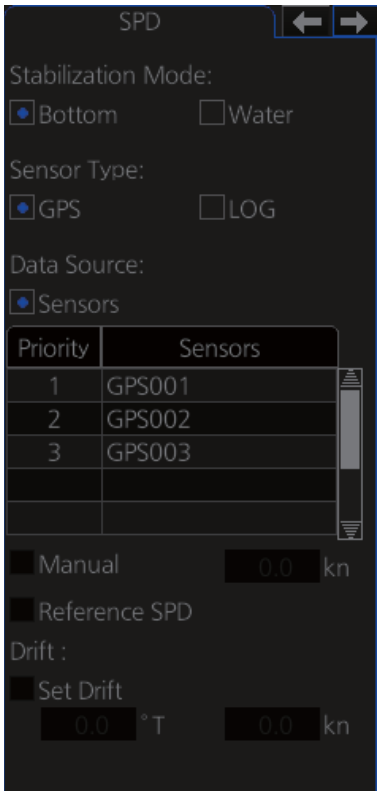
16.2.1 Sensors menu description

HDG page



Sensors: Select the heading sensor to use.
Analog Gyro: No use.
Manual: Set heading manually when there is heading sensor available.

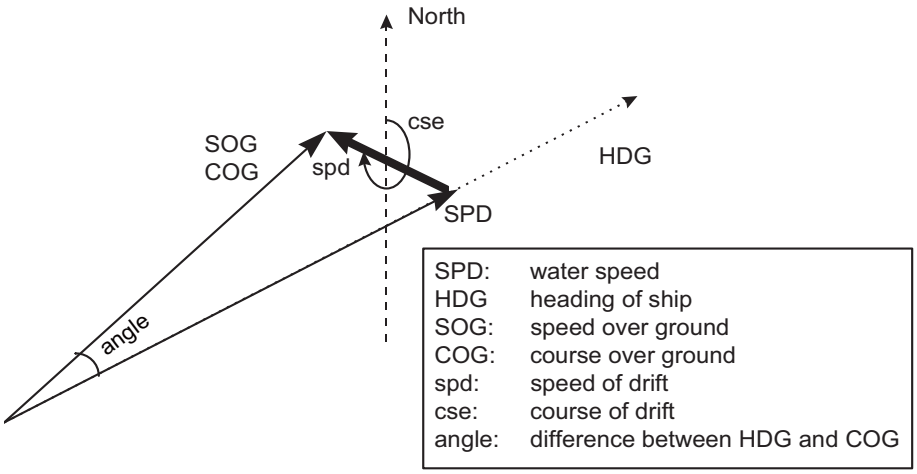
SPD page



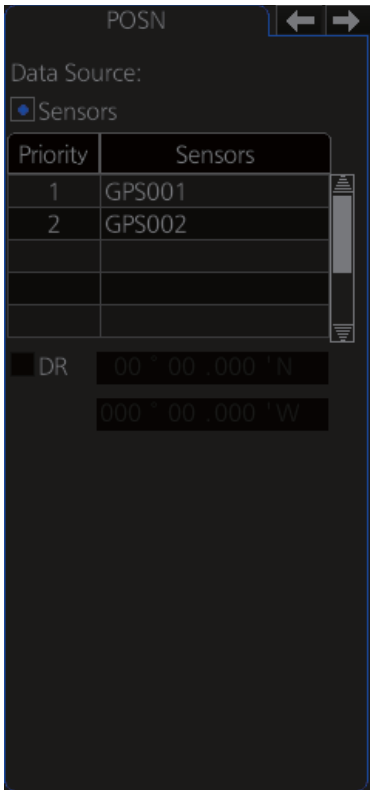
Stabilization Mode: Select the water stabilization mode: Select [Bottom] for ground stabilization, or select [Water] for sea stabilization.
Sensor Type: Select [GPS] in case of a GPS navigator, or [LOG] for speed log.
Data Source: Check [Sensors] to use a sensor in the [Sensors] list, or click [Manual] to enter speed manually. Use [Manual] when no speed source is available.
Manual: Input speed manually. Check [Water] in [Stabilization Mode] and deactivate the AIS function to enable entry.
Reference SPD: Check to use radar as the source for speed and course. (Not available with the System Sensor Settings.)
Set and drift: Check the [Set Drift] checkbox to manually set speed and course of drift. Note that you can select manual drift only if you deactivate the AIS function.

Angle = Difference between heading and COG
Spd = Speed component of the drift vector
Cse = Course component of the drift vector

Vector defined by (SOG and COG) is equal to vector sum of vectors defined by (SPD and HDG) and (set and drift)



POSN (Position) page



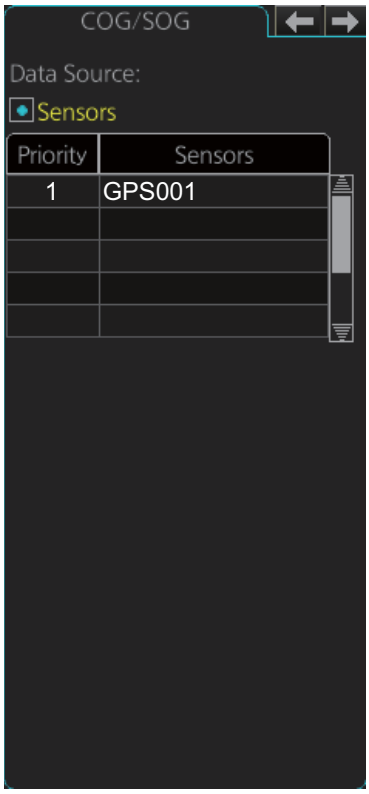
The sensor label (here, GPS001, GPS002) indicates the name of the sensor.

Data Source: Check [Sensors] to use a sensor in the [Sensors] list, or click [DR] to enter position manually. When the position source is changed based on priorities and signal validity to another position source, then you get the Alert 471 "Position Source Change".

DR: Check [DR] when no position source is available.

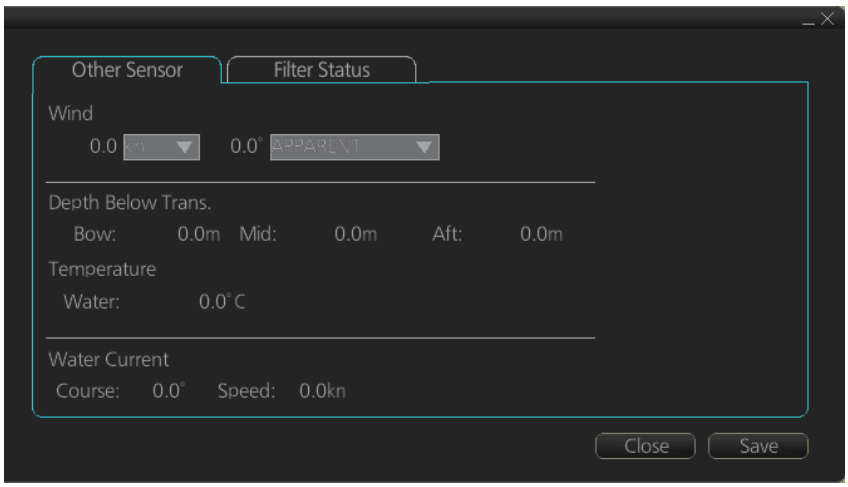
COG/SOG page

Select the source (GPS receiver) for speed over the ground and course over the ground.



Other sensors page

The [Other Sensors] page is accessed from the chart mode. Open the menu and select [Other Sensor Settings].



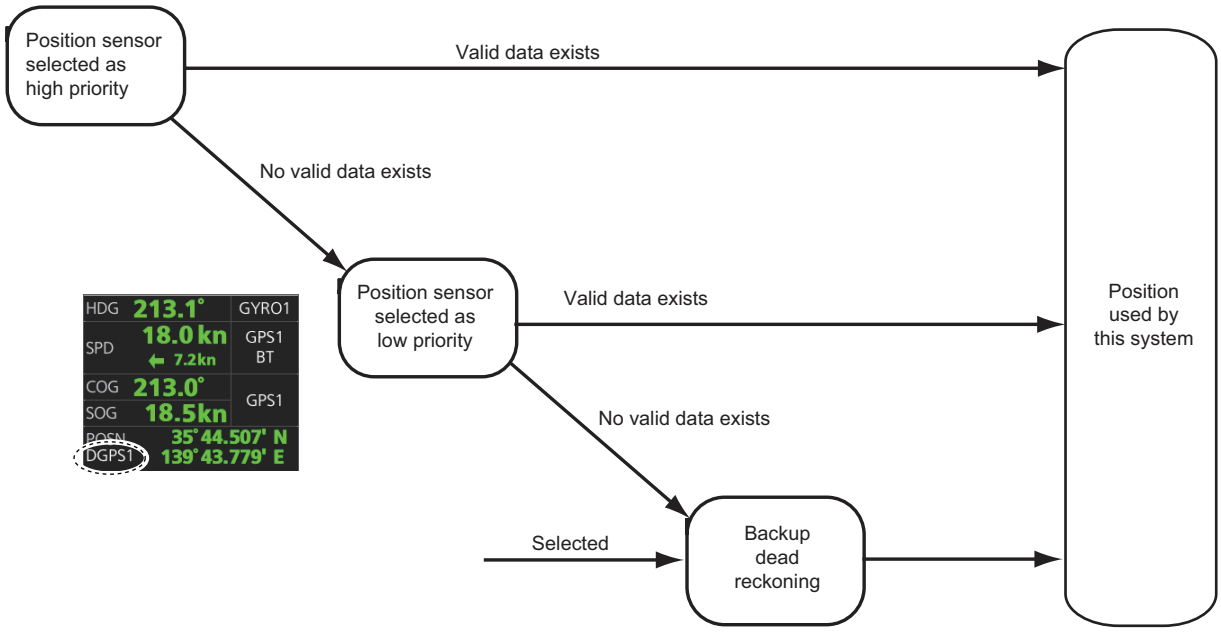
Wind: Wind (True, Theoretical or Apparent) speed (kn or m/s) and direction are displayed. See section 16.9.
Depth Below Trans: Depth from hull at bow and aft to bottom. A depth alert value may be entered to alert you when the depth is within the value set.
Temperature: Water surface temperature.
Water Current: Tide at own ship's position.

16.3 Source of Position

The figure below shows how source for position is chosen. The position sensors have either primary or secondary as input for their calculation. DGPS position sensors are considered more accurate than other position sensors.

The latitude and longitude position is shown at the top-right position on the chart radar display, and in the example below the position source is DGPS. Other indications that may be displayed in the position area are as follows:

- **DR**: Shown in yellow when position source is dead reckoning.
- **DGPS, GPS**: Name of position source.



If the system changes the source of position because of lost sensor data, the system immediately generates the Alert 471 "Position Source Change".

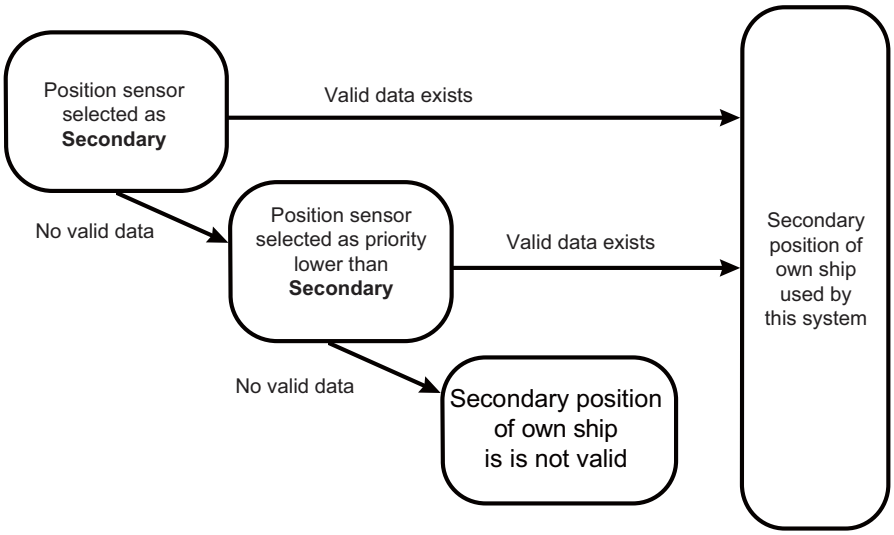
16.4 Primary and Secondary Positions of Own Ship

The system has two different positions for own ship: System position, primary position and secondary position.

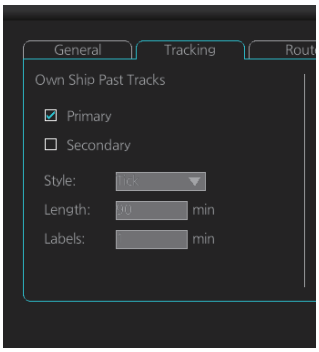
- **Primary position**: Position generated by position source chosen as primary position source.
- **Secondary position**: Position generated by position source chosen as secondary position source.

The position source for primary position of own ship is chosen as Primary on the [POSN] page of the [Sensor] menu.

The position source for secondary position of own ship is chosen as Secondary on the [POSN] page of the [Sensor] menu. Secondary position of own ship is not available as latitude/longitude value for the user.



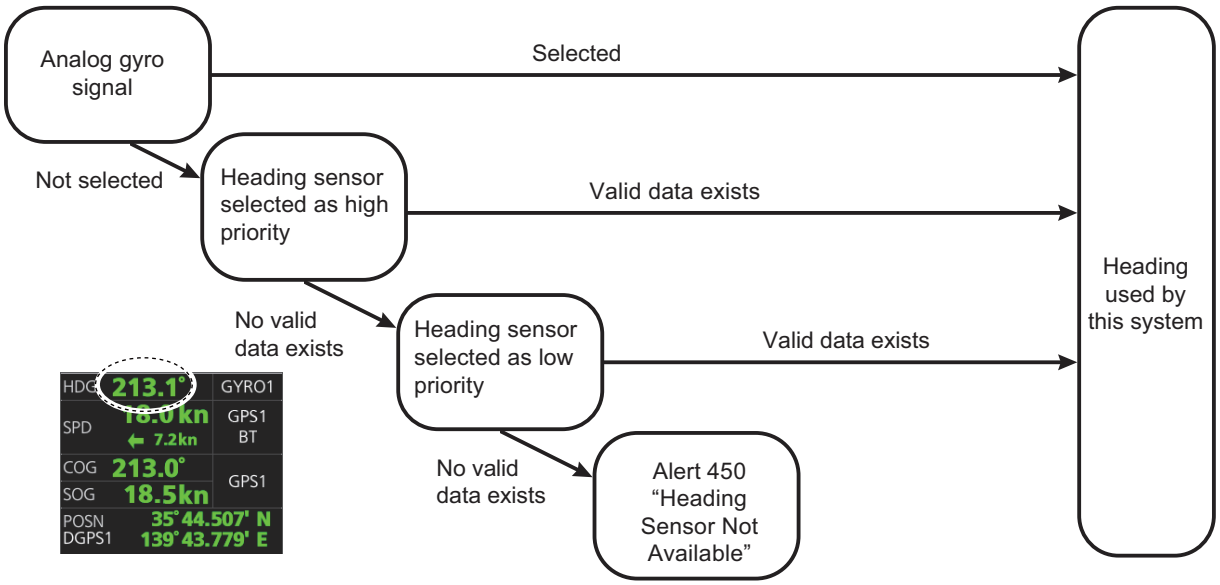
Primary and secondary positions of your ship may be plotted on the chart display with the past tracks feature. You can control their visibility, etc. from the [Tracking] page of the [Symbol Display] menu, shown in the right figure. In this example, past tracks are plotted using the primary position-fixing equipment.



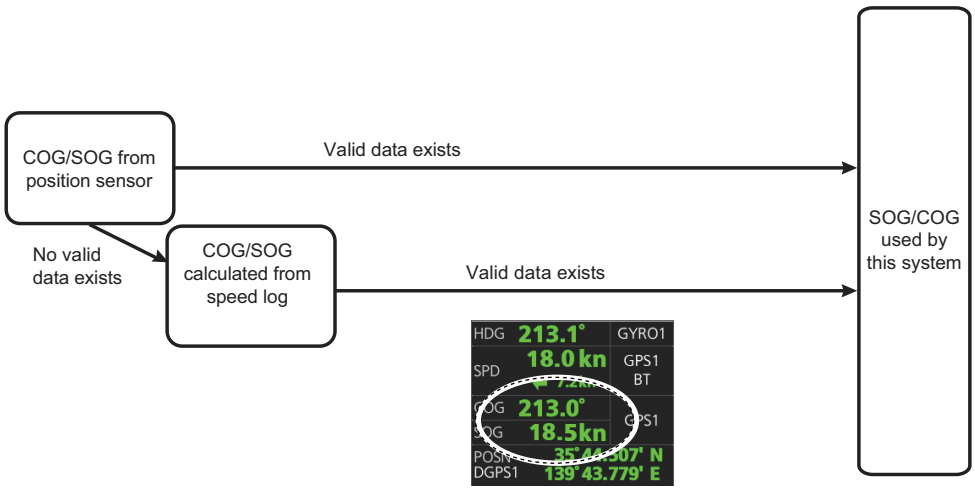
16.5 Source of Navigation Data

The figure below shows how various sources of navigation data are chosen. "SOG, COG" is speed over the ground and course over the ground, respectively. "SPD" is speed through the water.”Drift” is the difference between speed through the water and speed over ground.

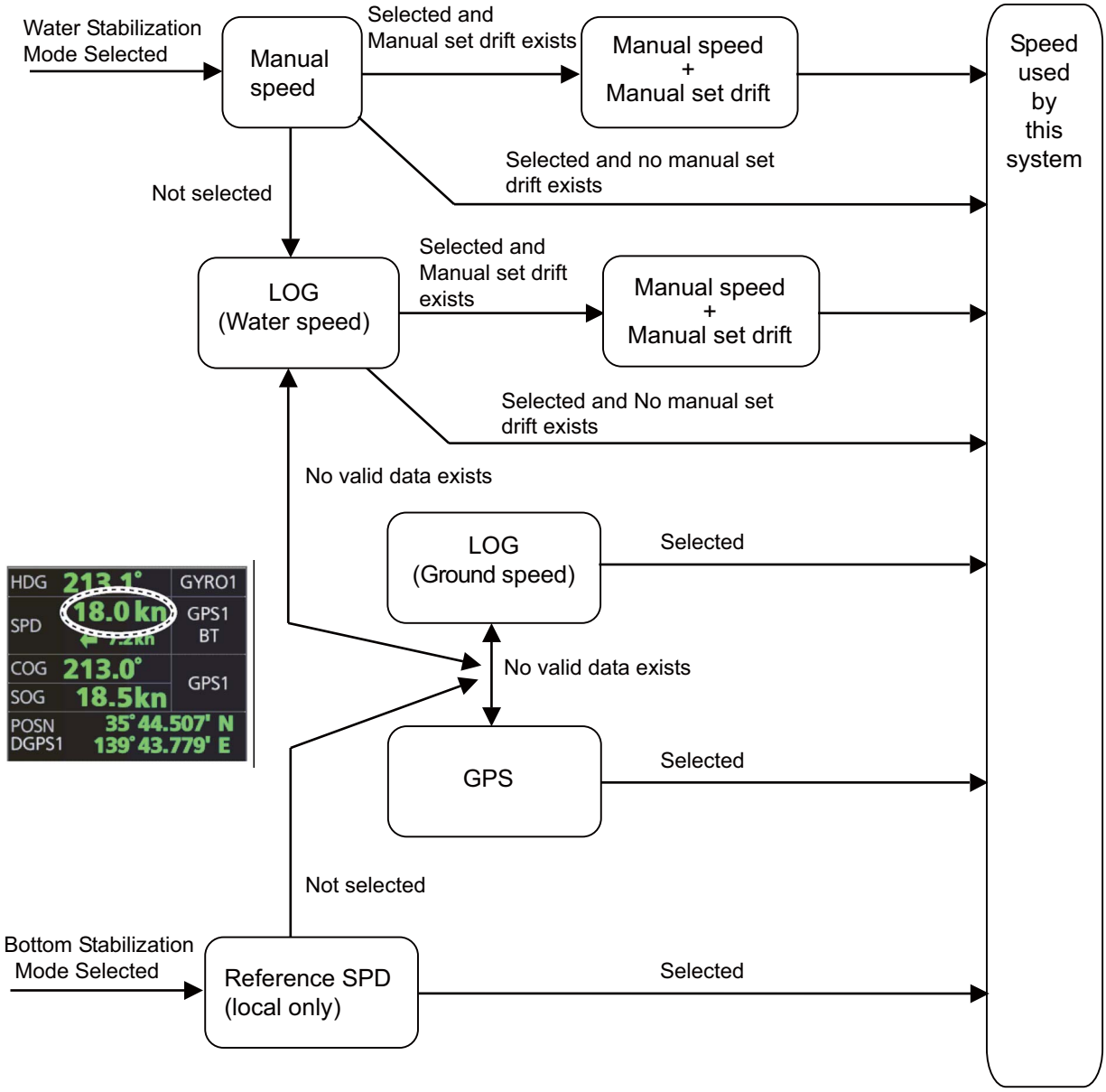
Heading used by the system is shown at the top-right position on the chart radar display. In the example shown below, heading is received from a gyrocompass and it is shown without additional text, meaning the value is referenced to true North. Additional gyro-related text that may appear is "(GYRO-A)" if the value is referenced to magnetic North.



SOG/COG used by the system is shown at the top-right position on the chart radar display. In the example below, COG and SOG are from chosen position sensors and this is indicated with the text "GPS*" or "LOG*" (* is the number of sensors).



Speed used by the system is shown at the top-right position on the chart radar display.The figure below shows the source of water speed is used for drift calculation.



Alert related to SOG, COG, speed and heading components

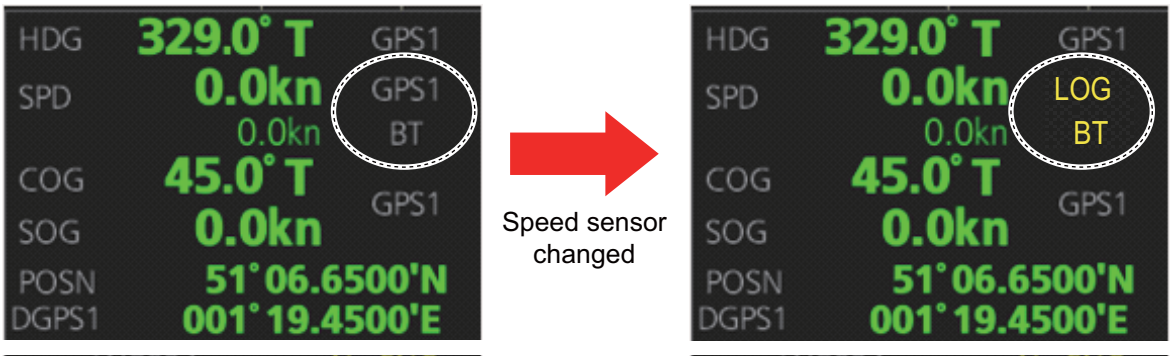
It is possible that the operator has not chosen any speed or heading sensors, or that the chosen sensors do not have any valid values. This kind of a situation is critical for the system, because it cannot even perform dead reckoning.

When no heading source is available, the system generates the Alert 450 "Heading Sensor Not Available."

When no speed source is available, the system generates the Alert 453 "SDME Sensor Not Available."When no COG/SOG data is available, the system generates the Alert 279 "COG/SOG Not Available."

16.6 Switching of Sensor and Resulting Indication

When a sensor cannot be used because of some problem, the system automatically switches the sensor. When this occurs the name of the newly selected sensor appears in yellow.



16.7 Filter Status

The ECDIS incorporates a filter that receives raw sensor data, checks sensor integrity and processes sensor data to produce a continuous estimate of ship's position and motion.

By default, the filter uses data from all available sensors for filtering and integrity monitoring. The exception is heading data; only the selected heading device affects the output of the filter, but other heading sensors (including magnetic compasses) are used for integrity monitoring.

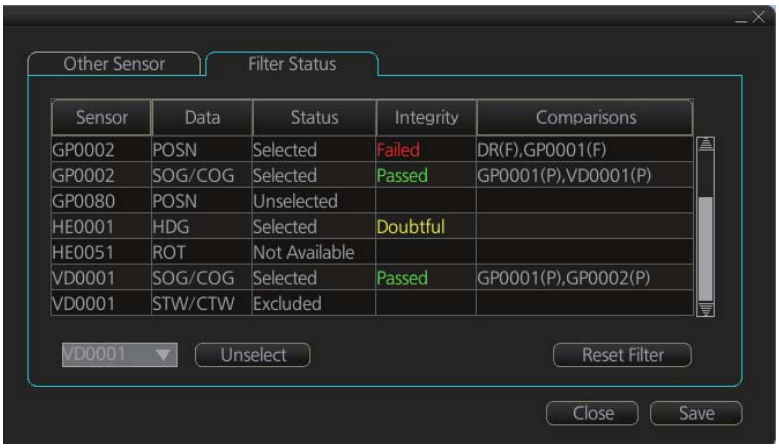
Sensors may be excluded manually or automatically. An excluded sensor participates in neither integrity monitoring or filtering. The filter automatically excludes a sensor from use if the sensor fails the first level of integrity check (for example, if a sudden jump is detected). If the actual integrity check fails for some reason and the filter is able to identify the faulty sensor, the faulty sensor is automatically excluded.

Sensor integrity is determined by: (1) monitoring the statistical accuracy of each sensor independently and analyzing the input values and using the information of the type of sensor, and (2) monitoring the difference between pairs of sensors. The result is either [Passed] or [Failed]. When there is no other source to compare with, the result is [Doubtful]. If there are multiple sources with which the sensor can be compared with, the result is [Failed] if all the pairwise comparisons have failed, otherwise the result is [Passed].

The methods of integrity monitoring are outlined in the table below.

Sensor	Comparison
Position	• Comparison with other position sensors. • Comparison with dead reckoning position.
Heading	• Comparison with other heading sensors. • Comparison with a COG sensor (used only if other heading sensors are not available and if COG is high enough).
Speed over the ground	• Comparison with other SOG sensors. • Comparison with water speed sensors is a secondary option (used only if other SOG sensors are not available).
Speed through the water	• Comparison with other STW sensors. • Comparison with STW sensors is a secondary option (used only if other STW sensors are not available).
Rate of turn	• Comparison with other rate of turn sensors.

The status and integrity of all sensors can be monitored from the [Filter Status] page in the [Other Sensor Settings] menu. Sensors can also be unselected and the filter reset from this page.



The [Status] column indicates sensor status as follows:

- [Selected] (sensor selected for use in filter)
- [Unselected] (sensor not used in filter)
- [Not Available] (no sensor information)
- [Excluded] (automatically excluded sensor)

The [Integrity] column indicates sensor integrity as either [Passed] (green characters) or [Failed] (red characters). The integrity evaluation is [Doubtful] (yellow characters) when there are no other sensors to compare with.

The [Comparisons] column shows the sensors compared and the integrity evaluation of compared sensors in parentheses. Using the illustration above as an example, SOG/COG data fed from GP0002 is compared with the sensors GP0001 and VD0001. The integrity evaluation for the compared sensors is [Passed].

To unselect a sensor manually, select the sensor from the drop-down list at the bottom left corner of the page, click the [Unselect] button then click the [Save] button. [Unselected] appears in the [Status] column. To reselect an unselected sensor, select the

sensor from the drop-down list, click the [Select] button. [Selected] appears in the [Status] column

The [Reset Filter] button functions to recover from sensor failure. When the button is operated:

- Automatically excluded sensors are re-included.
- All data history is erased.
- Output values are re-estimated using new data.
- Integrity monitoring is restarted using new data.

16.8 Position Alignment

The position alignment feature functions to fine tune ship's position by using radar, radar echo target and chart material.

If position alignment is in use, the Alert 640 "Chart Align: Over 30 Min." is generated every 30 minutes to remind the user to align position. The alert is automatically erased in 10 seconds.

16.8.1 How to align position

If the radar echo targets' symbols are not positioned correctly on the chart, there is either position error or gyro error or some combination of these errors.

Position may be aligned on the ECDIS display by moving own ship position or by moving radar target position. To align position, get into the Voyage navigation mode, click the [Offset] button at the top-right position on the screen, put the cursor on the correct position then click. The amount of offset, in bearing and range, appears to the right the [Offset] button.

The latitude and longitude position indication is shown in yellow characters when the position align feature is active.

16.8.2 How to cancel position alignment

Click the [Offset] button to cancel the position offset.

16.9 Wind Sensor

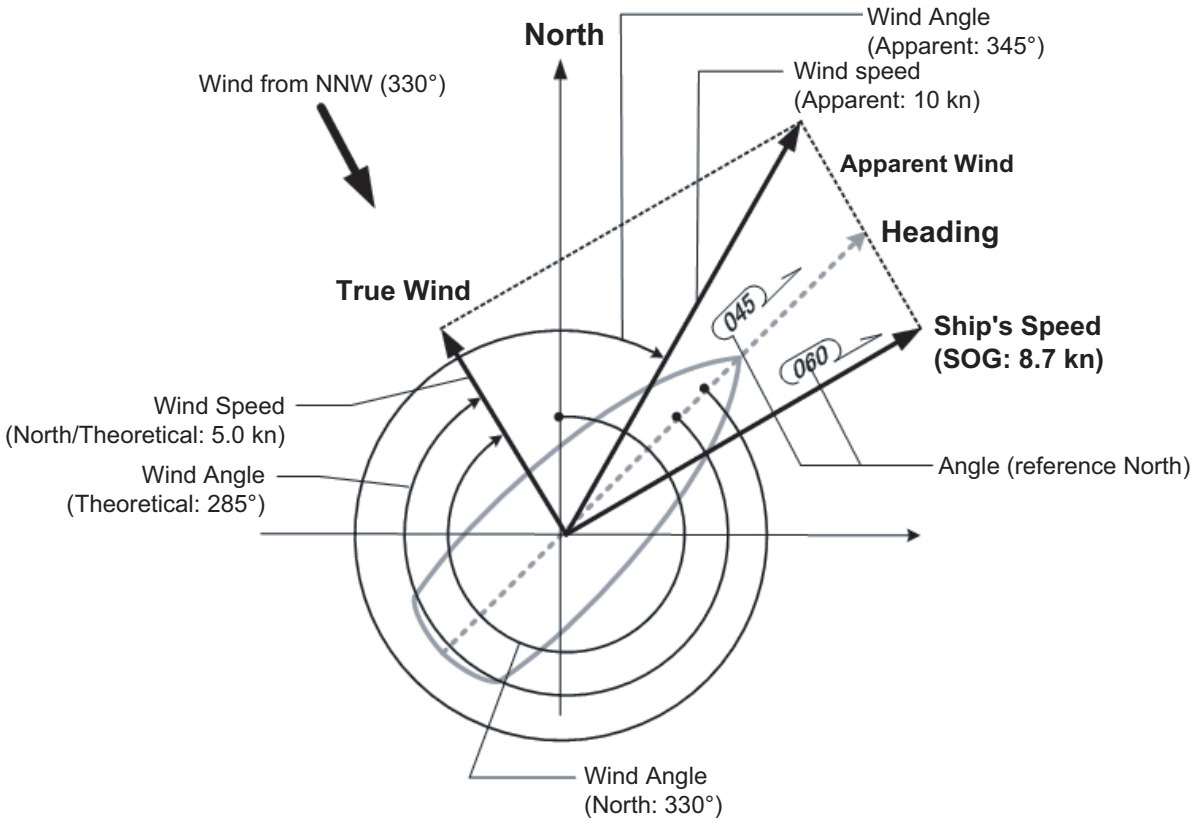
The chart radar can display and output wind data in the following three formats:
Apparent: Windmeter-measured wind speed and direction.
Wind angle reference: Heading
North: True wind angle, true wind speed
Wind angle reference: True North
Theoretical: True wind angle, true wind speed
Wind angle reference: Heading

The illustration below shows wind speed and direction with given ship data.

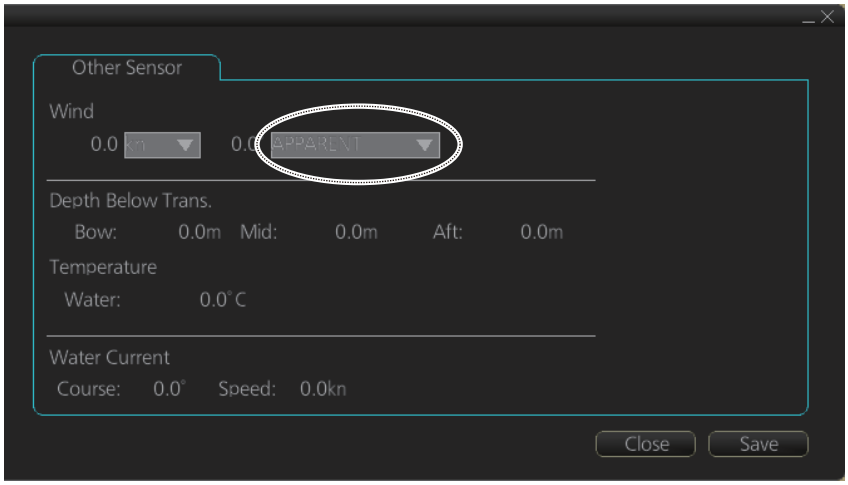
The wind values are as shown below.

Ship information:
COG: 60° SOG: 8.7 kn
Heading: 45°

	Wind angle	Wind speed
Apparent:	345°	10 kn
North:	330°	5 kn
Theoretical:	285°	5 kn



Apparent, north or theoretical wind may be selected from the [Other Sensor Settings] menu.

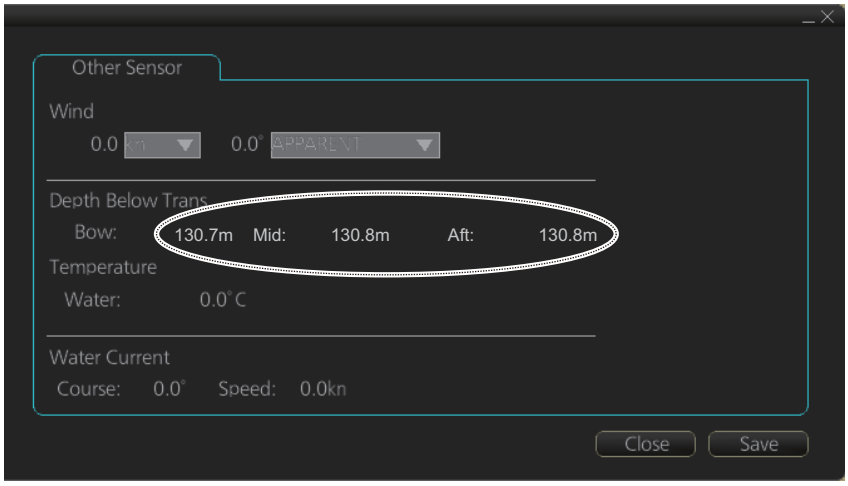


16.10 Depth Sensor

The depth output from a depth sensor (for example, echo sounder) is shown on the [Other Sensor] page in the [Other Sensor Settings] menu.

The content of the [Other Sensor] page depends on sensors connected.

In this example there are three transducers (bow, mid and aft) installed.



The system displays depth value as depth below the transducer. If required, you can get an alert when the measured depth is less than the "Echo Alarm Limit" setting at the [UKC] page in the [Overlay/NAV Tools] box. The system generates the Alert 485 "Depth Limit".

17. AIS SAFETY, NAVTEX MESSAGES

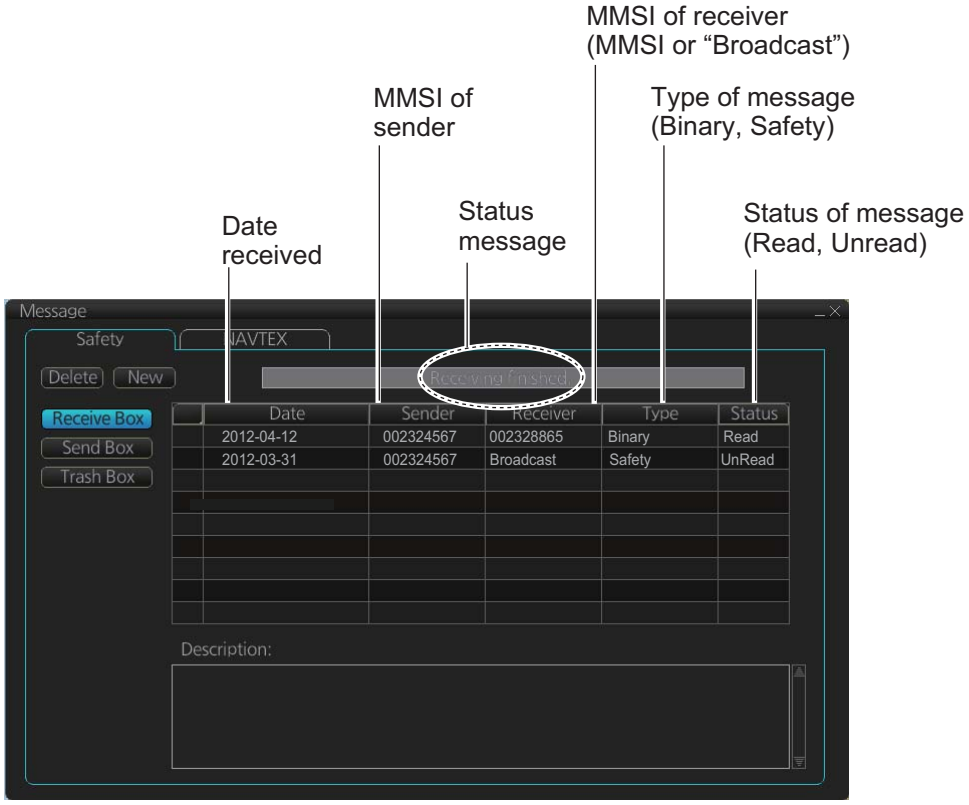
17.1 AIS Safety Messages

You can send and receive messages via the VHF link, to a specified destination (MMSI) or all AIS-equipped ships within communication range of your ship. Messages can be sent to warn of safety of navigation, for example, an iceberg sighted. Routine messages are also permitted. Short safety-related messages are only an additional means to broadcast safety information. They do not remove the requirements of the GMDSS.

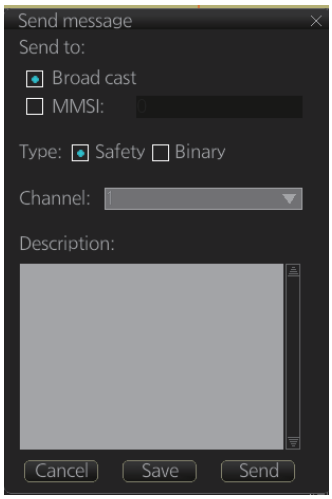
17.1.1 How to send an AIS safety message

Note: If you are using the Trackball Control Unit RCU-026, display the software keyboard ([DISP] button, [ ], [ON] on the InstantAccess bar) before starting this procedure.

1. In the Voyage navigation mode, click the [MSG] and [Safety MSG] buttons on the InstantAccess bar to show the [Message] dialog box.



2. Click the [New] button.
3. At [Send to], select where to send the message. Select [Broadcast] to send the message to all AIS-equipped ships within communication range, or select [MMSI] and enter the MMSI of the ship where to send the message.
4. At [Type], select the type of message, [Safety] or [Binary] (routine).
5. At [Channel], select the channel to use to send the message.
6. At [Description], enter the text of your message. The no. of characters available depends on the type of message.
   Safety message broadcast: 161 characters
   Binary message broadcast: 156 characters
   Safety message addressed to MMSI: 156 characters
   Binary message addressed to MMSI: 151characters
7. Click the [Send] button to send the message.

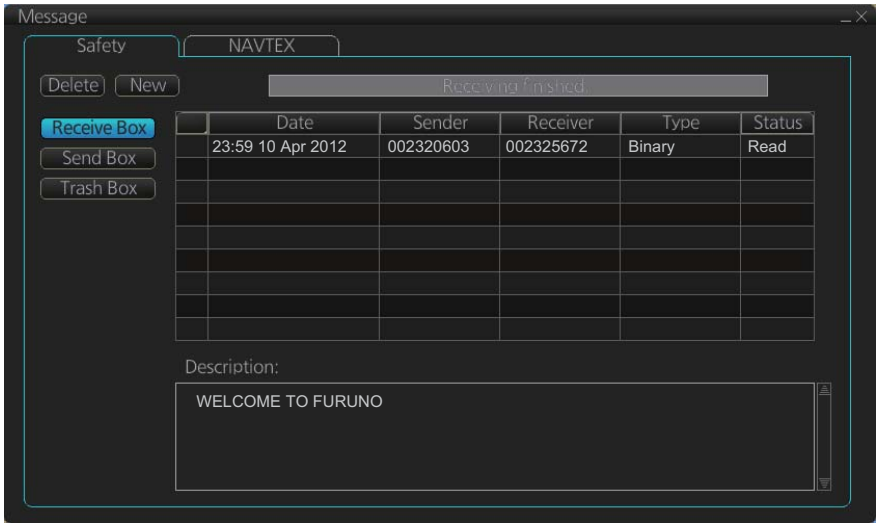


17.1.2 How to manage received and sent AIS safety messages

When an AIS message is received, the Alert 539 "AIS Message Received" appears. Do the following to view the message.

How to display the Messages dialog box, view a message

Click the [MSG] and [Safety MSG] buttons on the InstantAccess bar. Click the [Receive Box] or [Send Box] button as appropriate. Click a message to view its contents.



How to delete a received or sent message

1. Click the [Receive Box] or [Send Box] as appropriate.
2. Click the box that is before the date to show a checkmark. (All messages can be checked or unchecked with the context-sensitive menu. Right-click the box to the left of "Date" then select [Check All] or [Uncheck All] as applicable.)
3. Click the [Delete] button.

How to delete received, sent messages permanently

1. Click the [Trash Box] button.
2. Click the box that is before the date to show a checkmark. (All messages can be checked or unchecked with the context-sensitive menu. Right-click the box to the left of "Date" then select [Check All] or [Uncheck All] as applicable.)
3. Click the [Delete] button.

17.2 Navtex Messages

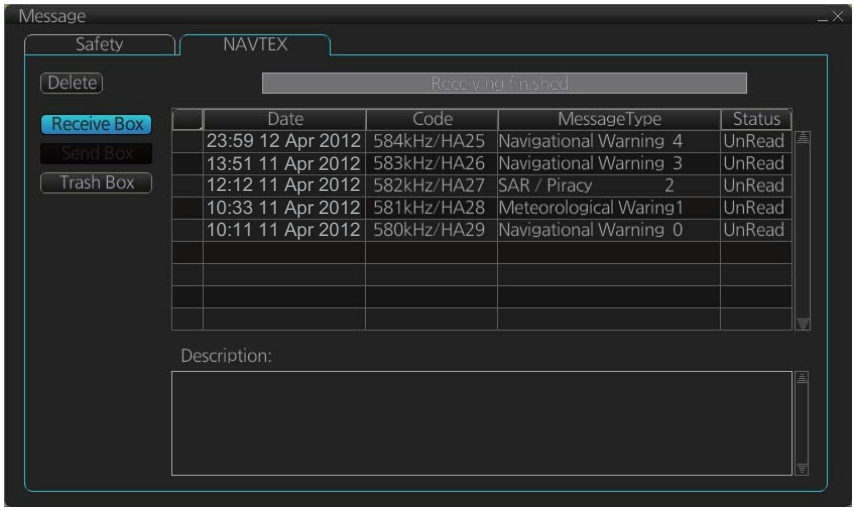
Navtex (Navigational Telex) is an international automated medium frequency direct-printing service for delivery of navigational and meteorological warnings and forecasts, as well as urgent marine safety information to ships.

Navtex messages can be received and read in the Voyage navigation mode.

17.2.1 How to receive Navtex messages

To display a received NAVTEX message, do the following:

1. Click the [MSG] and [NAVTEX MSG] buttons on the InstantAccess bar.



2. Click the message to view. The text of the message appears in the [Description] box.

17.2.2 How to manage received Navtex messages

How to delete received Navtex messages

1. Click the [MSG] and [NAVTEX MSG] buttons on the InstantAccess bar.
2. Click the [Trash Box] button.
3. Click the box that is before the date to show a circle in the box. (All messages can be checked or unchecked with the context-sensitive menu. Right-click the box to the left of "Date" then select [Select All] or [Deselect All] as applicable.)
4. Click the [Delete] button.

How to deleted received Navtex messages permanently

1. Click the [MSG] and [NAVTEX MSG] buttons on the InstantAccess bar.
2. Click the box that is before the date to show a checkmark in the box. (All messages can be checked or unchecked with the context-sensitive menu. Right-click the box to the left of "Date" then select [Select All] or [Deselect All] as applicable.)
3. Click the [Delete] button.

18. TT AND AIS DISPLAYS

Tracked targets and AIS targets can be overlaid on the chart. Only the differences between the radar and chart TT and AIS displays are described here.

The data of received radar-tracked targets must have reference to ground. If the data does not meet that criteria, target vectors are not shown and the indications COG and SOG in the TT info data box show [missing].

18.1 TT Display

18.1.1 TT symbols

Symbol	Default color	Name	Description
	Green	Past position point	Marks a past position of a TT.
	Green	Target under manual acquisition	A target acquired manually is initially indicated with a dashed circle.
	Red	Target under automatic acquisition	A target acquired automatically is initially indicated with a thick, dashed circle.
	Green	Acquired target	Solid circle with vector indicating steady state tracking (within three minutes after acquisition)
	Red	Acquired target in ACQ zone (before ACK)	Solid circle with vector indicating steady state tracking (within three minutes after acquisition)
	Red	Dangerous target	Dangerous TT (thick, solid circle)
	Green	Reference target	Used to calculate own ship's over-the-ground speed (echo-referenced speed) for ground stabilization.
	Green	Lost target	Marks a lost target.
	Green	Target selected	Target selected to show its data.

18.1.2 TT symbol color and size

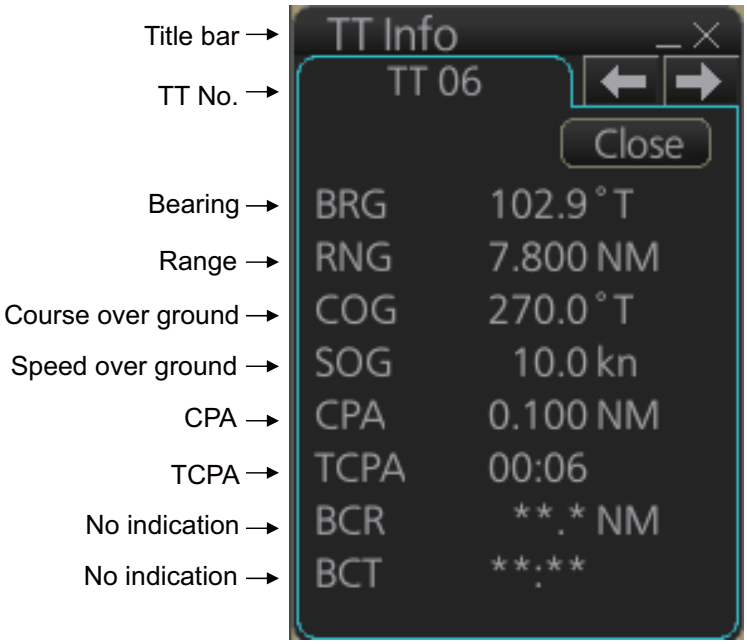
Do the following to select TT symbol color and size. Note that the color of the AIS symbol is also changed.

1. Click the [DISP], [SET] and [Symbol DISP] buttons on the InstantAccess bar to show the [Symbol Display] menu.
2. Click the [Targets] tab.

3. Select the color among, green, blue, black, magenta and brown, with the [Color] pull-down list.
4. Select the size from standard or small, with the [TT Size] pull-down list.

18.1.3 How to display tracked target data

Control Unit: Put the cursor on a target then push the **TARGET DATA** key.
Trackball: Click the target for which you want to show its data.



To erase data from a data box, click the appropriate close data button.

The basic target data display for a TT consists of the following information:

- Target's number. Target numbering starts from "01". When a target is erased the number will not be reused until the power is re-set or more than 100 targets are acquired.
- Bearing (BRG) and distance (RNG) of the target from own ship
- True speed (SOG) and true course (COG) of the target
- CPA and TCPA. A negative TCPA value means that you have already passed the closest point and the TT is going away from own ship.
- Bow Closest Range (BCR) and Bow Closest Time (BCT)

18.1.4 Past position point attributes

You can define past position point attributes for tracked targets by points and style.

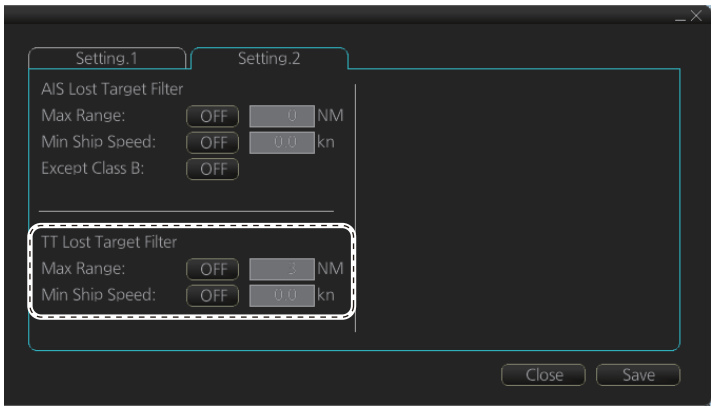
1. Click the [DISP], [SET] and [Symbol DISP] buttons on the InstantAccess bar to show the [Symbol Display] menu.
2. Click the [Targets] tab.

3. At [TT Points], select the number of points to show.
4. At [Style], select the style for the past position points. The choices are [Points] and [Points and Dots].

18.1.5 How to set the TT lost target alarm filter

If you are in a congested area the lost target alarm may sound against many AIS targets. In this case, you can prevent the alarm from sounding against TT that are beyond a certain range and/or smaller than a specific length.

1. Open the MENU and select [TT/AIS] and [Setting] then click the [Setting.2] tab.



2. In the [TT Lost Target Filter] window, set the maximum range to track a target and the minimum ship speed to track.
   Max Range: The maximum range at which to track a lost target. A tracked target not within this range is not tracked.
   Min Ship Speed: A tracked target whose speed is slower than set here does not trigger the lost target alarm.
3. Click the [ON/OFF] button to show ON or OFF as appropriate.

18.1.6 TT recording functions

Tracked target information is saved to the [Danger Targets] log. See section 18.5.

18.2 AIS Display

18.2.1 AIS symbols

The table below shows all the AIS symbols that appear on the chart.

Symbol	Default Color	Name	Description
	Green	AIS tracked target past position point	Marks a past position of an AIS target.
	Green	Sleeping AIS target	Denote sleeping AIS symbol. (Lines are thinner than Active AIS symbol.)
	Green	Activated AIS target	Denote active AIS target, with vector (Lines are thicker than sleeping AIS symbol.) Vessel name is shown (default setting).
	Green	Activated target, true scale symbol	Active AIS target with symbol shown in true scale.
	Red (fixed)	Dangerous AIS target	Target's CPA and TCPA are within the CPA and TCPA settings. Vector shown.
	Green	Heading-turn indicator	Shows target's direction of turning.
	Green	AIS ATON	Aids to navigation
	Green	Virtual AIS ATON	Denote virtual AIS
	Green	SAR-AIRCRAFT	
	Green	AIS base station	
	Green	AIS SART	
	Green	AIS select symbol	Target selected to display its data.
	Red (fixed)	AIS lost symbol	X is superimposed on the AIS target symbol and is flashing.

Note 1: The equipment continues to process AIS targets when the AIS feature is switched off. When the AIS is again turned on, symbols are immediately displayed.

Note 2: AIS symbols are momentarily erased after the screen is redrawn when the heading is changed from the Head-up mode.

Note 3: When no AIS data is received, the message "AIS receive error" appears in the [Alert] box. Check the AIS transponder.

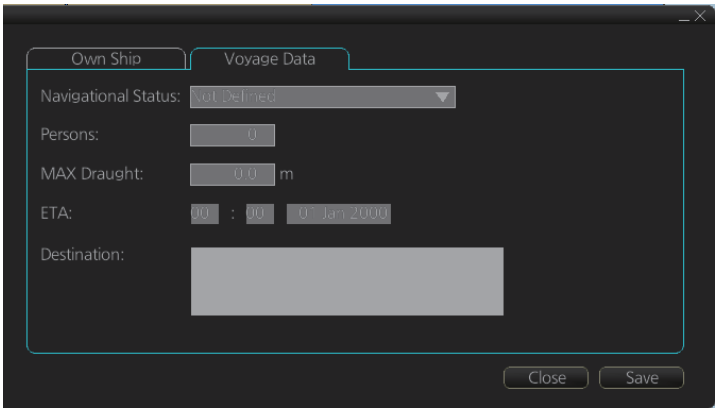
Note 4: A target is declared a lost target if it is not detected in five consecutive reporting periods.

Note 5: The color of the AIS symbols can be changed. See section 18.1.2.

18.2.2 Voyage data

Before you embark on a voyage, set your navigation status, ETA, destination, draught and crew, on the [Voyage Data] page in the [NAV Status] menu.

1. Open the MENU then click both [NAV Status] in the [TT/AIS] menu and the [Voyage Data] tab.



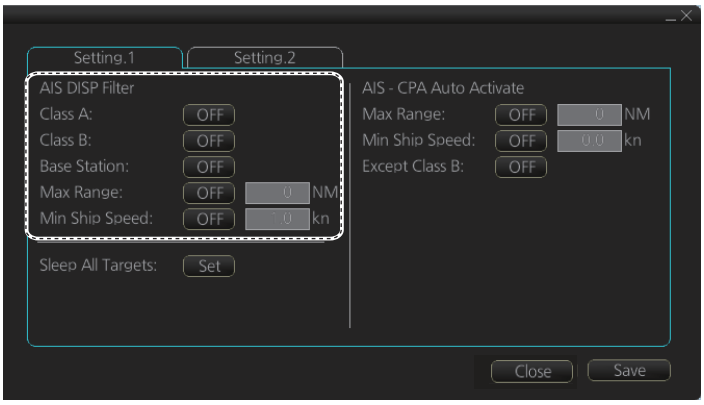
2. Click the [Navigational Status] drop-down list then select your navigational status, from the list below.

- Underway using engine
- At anchor
- Not under command
- Restricted maneuverability
- Constrained by her draught
- Moored
- Aground
- Engaged in fishing
- Under way sailing
- Reserved for high speed craft
- Reserved for wing in ground
- Reserved for future use (x3)
- AIS-SART (active)
- Not defined

3. Enter the number of persons onboard (0000-8191) at [Persons].
4. Enter ship's draught (0.0 - 25.5 (m)) at [MAX Draught].
5. Enter your ETA at [ETA].
   Day: two digits
   Month: Three-character abbreviation
   Year: Four digits
6. Enter your destination at [Destination], using a maximum of 20 characters.
7. Click the [Save] button to save the settings.

18.2.3 How to filter AIS targets

1. Right-click [AIS] on the [TT/AIS] page in the [NAV Tools/Overlay box], select [Setting] and open the [Setting.1] page.
   (The [Setting.1] page can also be opened from the menu (MENU→[TT/AIS]→[Setting]→[Setting.1].)



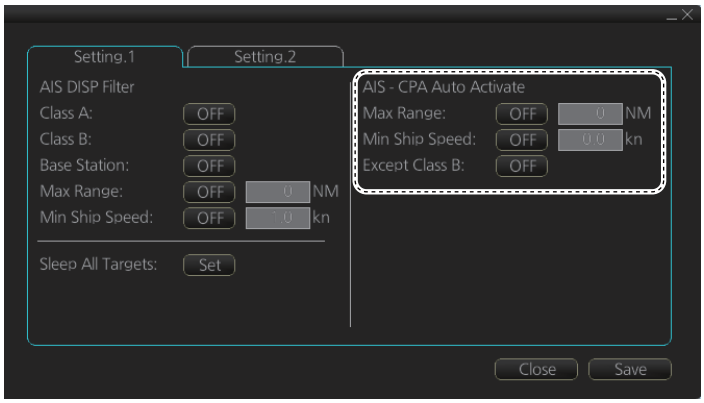
2. In the [AIS DISP Filter] window, set each item referring to the description below.
   - Click the button of [Class A], [Class B] and [Base Station] to show [OFF] or [ON] to hide or show those targets.
   - Set the maximum range with [Max Range]. Any target beyond the range set here will not be displayed.
   - Set the ship speed for AIS targets, with [Min Ship Speed]. Any AIS target whose speed is lower than that set here will not be displayed.
3. Click the [Save] button to save settings. Click the [Close] button to close the dialog box.

   Note: AIS and tracked target viewing limitations are as follows:
   - AIS and tracked targets are displayed on top of chart 1:1,000,001 for S57 charts.
   - AIS and tracked targets are displayed on top of chart 1:1,900,001 for ARCS charts. This allows display of AIS and tracked targets on top of the largest scale ocean charts (original scale 1:3,500,000) when they are zoomed to "overscale".

18.2.4 How to set conditions for automatic activation of sleeping targets

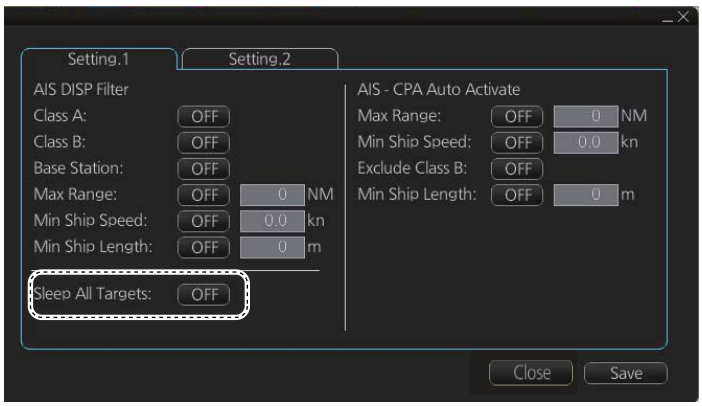
The AIS target automatic activation feature is turned on or off from the [TT/AIS] page in the [Overlay/NAV Tools] box. Set the conditions for automatic activation as shown below. The CPA/TCPA alarm must be active to get automatic activation of AIS targets.

Right-click [AIS] on the [TT/AIS] page in the [NAV Tools/Overlay box], select [Setting] and open the [Setting.1] page.



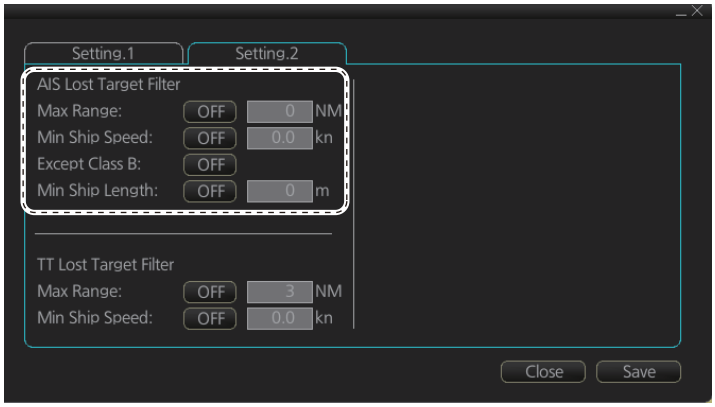
18.2.5 How to sleep all activated targets

You can sleep all activated targets. Right-click [AIS] on the [TT/AIS] page in the [NAV Tools/Overlay box], select [Setting] and open the [Setting.1] page. Click the [Sleep All Targets] button to sleep all activated targets.



18.2.6 How to set the AIS lost target alarm filter

You can select what AIS targets to exclude from the AIS lost target alarm, on the [Setting.2] page in the [TT/AIS] menu.

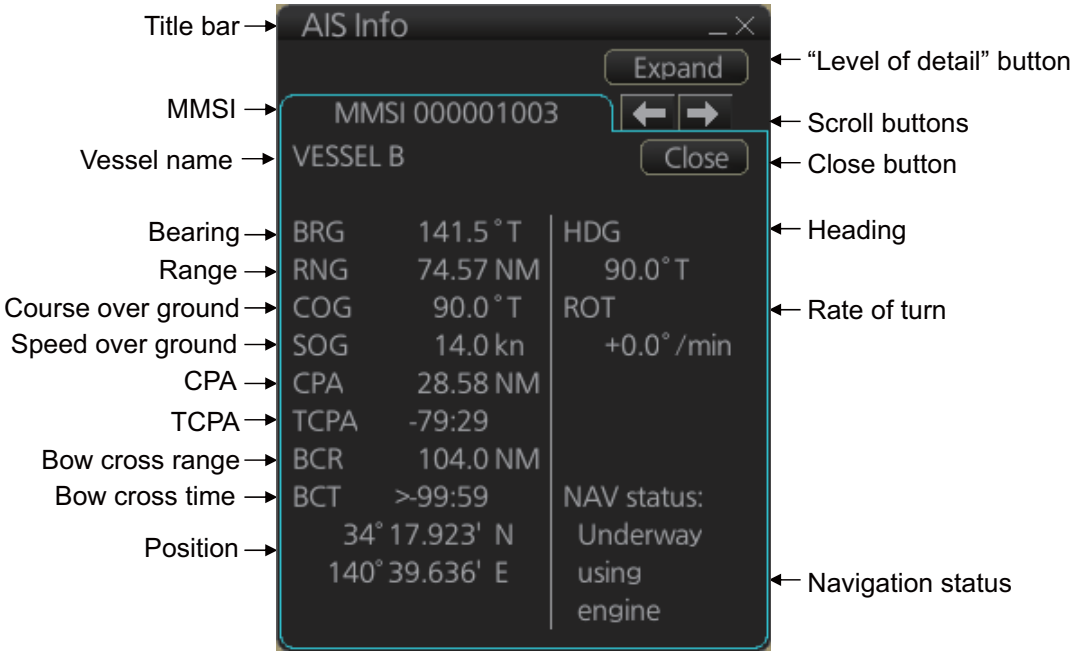


Max Range: Set the max. range at which a target must be to be declared a lost target.
Min Ship Speed: Set the minimum ship speed a target must obtain to be declared a lost target.
Except Class B: Exclude class B AIS targets from the AIS lost target alarm.

18.2.7 How to display AIS target data

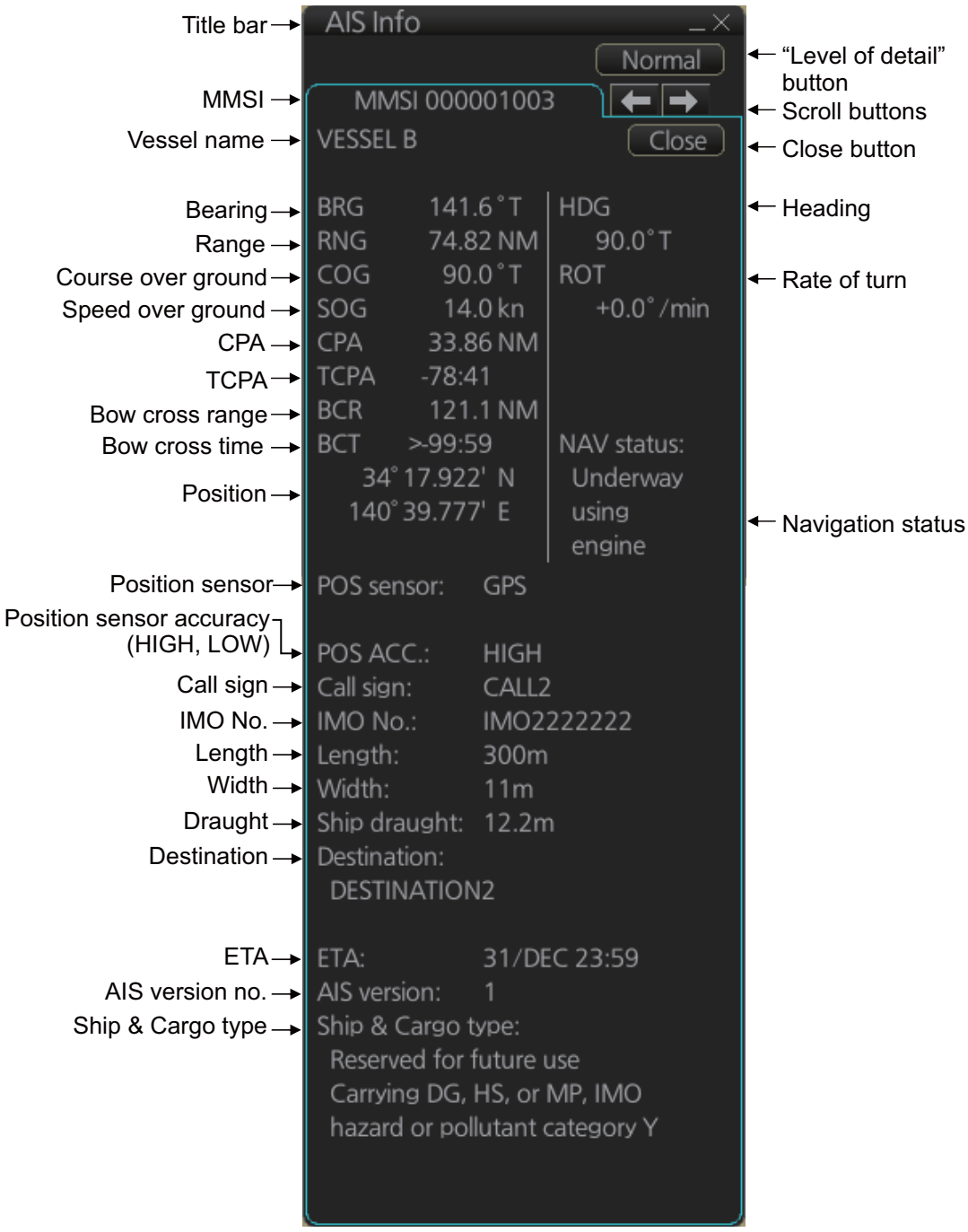
Normal data

Put the cursor on an AIS target then push the left button.



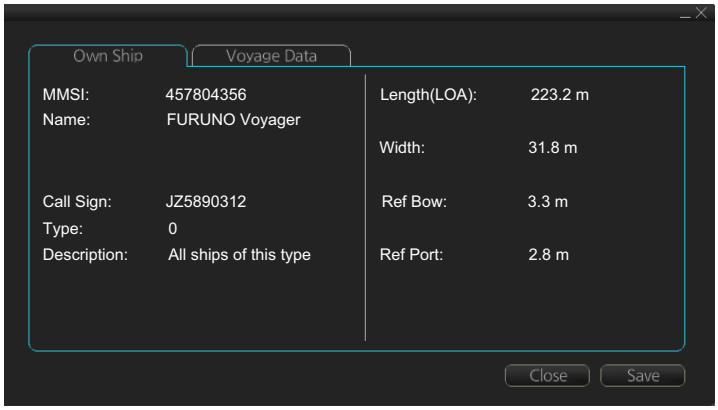
Expanded data

Put the cursor on a desired AIS target then push the left button. Click the [Expand] button (level of detail) on the [AIS Info] box to show expanded AIS data.



18.2.8 How to display own ship data

You can see own ship's data on the [Own Ship] page in the [NAV Status] menu. Open the menu then click both [NAV Status] in the [TT/AIS] menu and the [Own Ship] tab.



19. RECORDING FUNCTIONS

The chart radar records various voyage-related items like movement and position of own ship and dangerous radar targets (from Radar). These items are recorded in the following logs:

Event log:	Records user events and position events.
NAV log:	Records entire voyage (i.e., a sailing of a route from first point to the last, also MOB data), details (position, speed and course every minute), chart usage (information on charts used for display).
Target log:	Records dangerous TT.
Alert log:	Records alerts generated by the system.
Chart log:	Records the install and update history for the ENC and C-MAP charts.

19.1 How to Record User, Position Events

19.1.1 User events

A user event records a comment about a specific event to the event log book. User events can be shown on the chart area by turning them on from the [Tracking] page of the [Symbol Display] menu.

To record a user event:

1. Click the [Record], [Event Log] and [User Event] buttons on the InstantAccess bar to show the [Record User Event] window.

2. Enter a comment. Click the [OK] button to finish and close the text box.

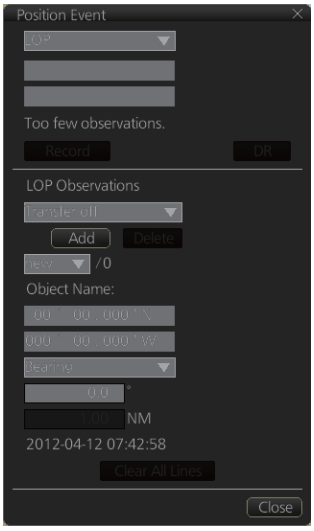
A navigation event symbol appears at own ship position and the event is recorded to the Event log.

19.1.2 Position events

The operator may manually save positions to the [Event] log by position or LOP (Line of Position:

To record a position, do the following.

1. First you should locate the position of your observation on the display. Put the cursor on the desired location on the chart display then click [Record], [Event Log] and [POSN Event] on from the InstantAccess bar to show the [Position Event] dialog box.



2. At the list box at the top of the dialog box, select position type.
   [LOP]: Latitude and longitude position of a fixed object at ship's position.
   [Position]: Ship's position fed from navigator selected.
3. For [Position], click the [Record] button to save the position observation into the [Voyage] log.
4. For LOP, see the description below.

Position fixes defined by Line of Position (LOP)

A plotted line on which a vessel is located, determined by observation or measurement of the range or bearing to an aid to navigation or other charted element. Two or more simultaneous observations can be combined to produce an estimate of the ship's current position. If the position is based on only two observations, it is an "estimated position" (EP); otherwise it is called a fix. A maximum of 6 observations can be entered to obtain a fix.

Basic operation: Coordinates of the aid to navigation can be entered into dialog boxes or they can be selected graphically on the chart. Click on a charted object (beacon, light, buoy etc.). Description of the object appears above coordinate boxes.

Default values for bearing and range are approximated from ship's current position information. The time of observation is stopped when the object is selected (or when the [Add] button is clicked). Click the [Add] box to include the observation in the fix computation. The counter shows "new/1", and a second observation may be entered. The word "new" indicates that the observation currently displayed is not yet included in the fix computation, and it appears as a dashed line or ring on the chart. The added observations can be edited or deleted after selecting them at the counter. When at least two measurements are entered, the EP or fix is computed and the coordinates are

shown in the top part of the dialog, and a position symbol appears on the chart. In the case of an EP, the letters EP are shown on the right side of the coordinates. If a valid position estimate cannot be obtained, a message is displayed under the coordinates. This may happen, for example, if the lines / circles have multiple crossings that are far apart, or if two lines are nearly parallel or don't intersect at all. The accuracy limit (estimated standard error) is 1.0 NM. If the estimate is valid, the [Record] box can be clicked to record the current position estimate in the [Voyage] log. Discrepancy between LOP result and ship position is also recorded in the log (this information may be viewed by Info query on the position event symbol on the chart - which is displayed if position event display is on in chart display settings).

Time transfer: If the observations are not simultaneous, they should be transferred to a common time. Transferring is based on dead reckoning of ship movement. If a position line (or ring) is transferred, the letters TPL are shown beside its timestamp on the chart. The method of transfer may be selected in the bottom of the dialog. **Transfer to latest** transfers the measurements as if they were all made at the time of the newest measurement. **Continuous transfer** transfers all measurements to real time. **Transfer off** can be used to check where the measurement origins are. The position estimate and the record function follow the same logic, which means that Transfer off shows a position that has no relevance and Transfer to latest sends an old position to the [Voyage] log (timestamp in the log does not match the position).

If you are satisfied with the position shown in the latitude and longitude fields, then click the [Record] button to save the position observation to the Voyage log. If you wish you can also enter latitude and longitude values manually.

Timeouts: The observations cannot be used long after they were made because dead reckoning is inaccurate.

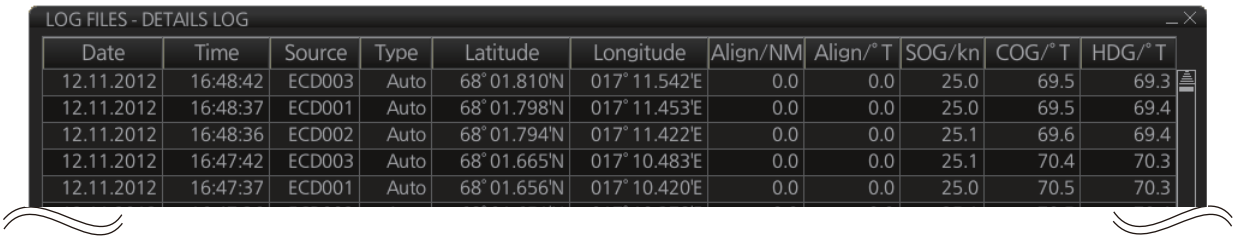
19.2 Details Log

The [Details] log contains voyage information, recorded once per minute.

- Date
- Time
- Source: No. of unit which generated log
- Type: Type of position data
  - Auto: Automatic input of position
- Latitude, Longitude: Position as output by selected sensor
- Align/NM, Align/°T: Range, bearing offset, if used
- SOG/kn: Speed over the ground
- COG/°T: Course over the ground
- HDG/°T: Heading
- CORR/°T: Gyro correction value, if used

How to view the Details log

To open the [Details] log, click the [Record], [NAV Log] and [Detail] buttons on the InstantAccess bar.



Date	Time	Source	Type	Latitude	Longitude	Align/NM	Align/°T	SOG/kn	COG/°T	HDG/°T
12.11.2012	16:48:42	ECD003	Auto	68°01.810'N	017°11.542'E	0.0	0.0	25.0	69.5	69.3
12.11.2012	16:48:37	ECD001	Auto	68°01.798'N	017°11.453'E	0.0	0.0	25.0	69.5	69.4
12.11.2012	16:48:36	ECD002	Auto	68°01.794'N	017°11.422'E	0.0	0.0	25.1	69.6	69.4
12.11.2012	16:47:42	ECD003	Auto	68°01.665'N	017°10.483'E	0.0	0.0	25.1	70.4	70.3
12.11.2012	16:47:37	ECD001	Auto	68°01.656'N	017°10.420'E	0.0	0.0	25.0	70.5	70.3

- **To print the log**, click the [Print Text] button.
- **To search the log**, do as follows:
  1) Click the [FInd] button to show the [Find text] box.

  2) Click the input box then enter the text to search.
  3) Select the search direction, up or down.
  4) To continue the search, click the [Find]button. To cancel the search, click the [Cancel] button.

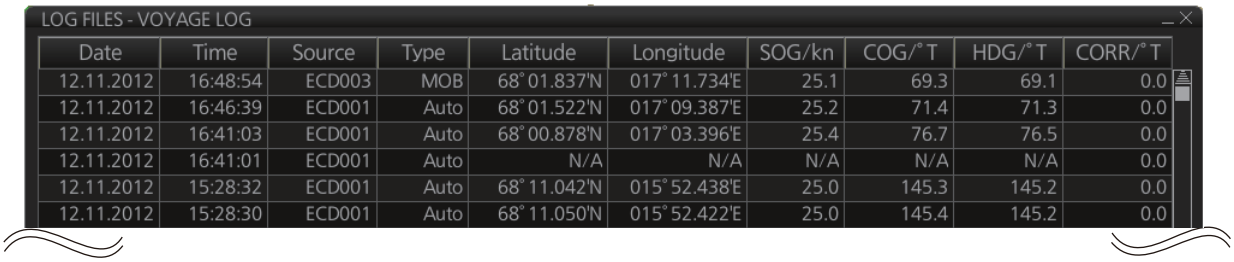
19.3 Voyage Log

The [Voyage] log records all voyage-related data of the past three months. Recorded events are:

- Date: Date of entry
- Time: TIme of entry
- Type: Log entry types
  - Auto: Automatic entry of ship position, in 1 to 4 hr intervals, set by operator.
  - Ship: Logged if speed or course exceed operator-set values.
  - MOB: MOB position, entered with [MOB] button.
  - User: Operator-entered position. The information entered in the [Description] box is logged.
  - Posdev: Operator-entered GPS position or LOP. The information entered in the [Description] box is logged.
- Latitude and Longitude: Latitude and longitude position
- SOG/kn, COG/°T, HDG/°T: Speed over the ground, course over the ground, heading.
- CORR/°T: Offset bearing, if used
- Wind/kn Wind/°T: Wind speed and angle
- Dist/NM: Offset distance
- Depth/m: Depth in meters
- Description: Description attached to a log entry (User, Posdev)

How to view the Voyage log

To open the Voyage log, click the [Record], [NAV Log] and [Voyage] buttons on the InstantAccess bar.


LOG FILES - VOYAGE LOG

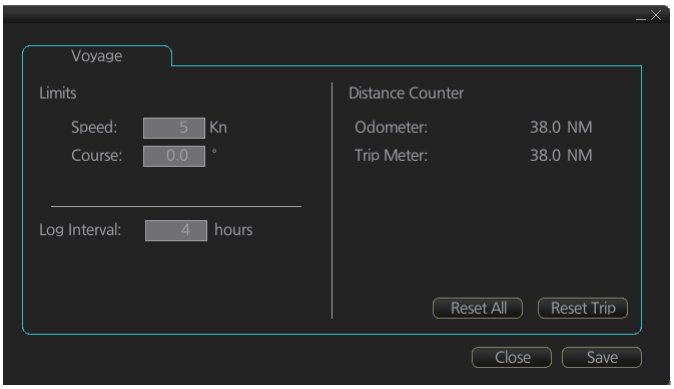
Date	Time	Source	Type	Latitude	Longitude	SOG/kn	COG/° T	HDG/° T	CORR/° T
12.11.2012	16:48:54	ECD003	MOB	68° 01.837'N	017° 11.734'E	25.1	69.3	69.1	0.0
12.11.2012	16:46:39	ECD001	Auto	68° 01.522'N	017° 09.387'E	25.2	71.4	71.3	0.0
12.11.2012	16:41:03	ECD001	Auto	68° 00.878'N	017° 03.396'E	25.4	76.7	76.5	0.0
12.11.2012	16:41:01	ECD001	Auto	N/A	N/A	N/A	N/A	N/A	0.0
12.11.2012	15:28:32	ECD001	Auto	68° 11.042'N	015° 52.438'E	25.0	145.3	145.2	0.0
12.11.2012	15:28:30	ECD001	Auto	68° 11.050'N	015° 52.422'E	25.0	145.4	145.2	0.0

- **To print the log**, click the [Print Text] button.
- **To search the log**, use the [Find] button.

19.3.1 How to set conditions of logging

The operator can define limits for course change and speed change of own ship to be recorded and also time period for automatic logging. To set them, do the following:

1. Open the menu and select the [Voyage] menu from the [NAVI Log] menu.



2. Set desired limits for speed, course and log interval.
   Speed: 1 - 10 kn, 1 kn interval
   Course: 1 - 30°, 1° interval
   Log Interval: 1 - 4 hr, 1 hr interval

When your speed or course changes by the amount set here, an entry is made in the [Voyage] log, at the interval selected.

19.4 Chart Usage Log

The [Chart Usage] log stores which charts were displayed on the ECDIS display area or which were used for chart alerts. To open the log, click [Record], [NAV Log] and [Chart Usage] on the InstantAccess bar. The following information is recorded in the chart usage log:

- Date and time chart was displayed
- Chart ID
- Center position of display (Lat, Lon)
- Chart source
- Chart edition
- Display scale
- Compilation scale
- The latest update included to chart
- Chart base

19.5 Danger Targets Log

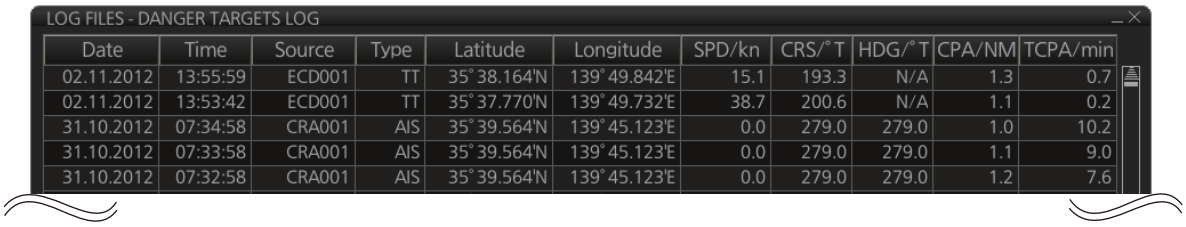
The [Danger Targets] log stores information about dangerous targets that are received from a radar (TTs) and/or targets that are received from an AIS transponder (AIS targets).

If a TT or AIS target is within the set CPA (Closest Point of Approach) and TCPA (Time to CPA), information of all TTs (including non-dangerous targets) are recorded into the danger target log. This data is as follows:

- Date: Date of entry
- Time: Time of entry
- Source: Unit which generated log
- Type: Type of dangerous target
- Latitude and Longitude: Latitude and longitude position of dangerous target
- SPD/kn: Speed of dangerous target
- CRS/°T: Course of dangerous target
- HDG/°T: Heading of dangerous target
- CPA/NM, TCS/min: CPA and TCPA of dangerous target
- Index: Radar target no. (TT), MMSI (AIS)

How to view the danger targets log

To open the [Danger Targets] log, click the [Record], [Target Log] and [Danger Target] buttons on the InstantAccess bar.

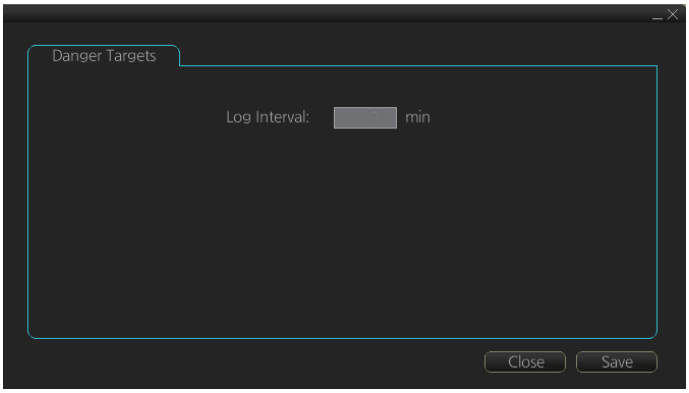

LOG FILES - DANGER TARGETS LOG

Date	Time	Source	Type	Latitude	Longitude	SPD/kn	CRS/° T	HDG/° T	CPA/NM	TCPA/min
02.11.2012	13:55:59	ECD001	TT	35° 38.164'N	139° 49.842'E	15.1	193.3	N/A	1.3	0.7
02.11.2012	13:53:42	ECD001	TT	35° 37.770'N	139° 49.732'E	38.7	200.6	N/A	1.1	0.2
31.10.2012	07:34:58	CRA001	AIS	35° 39.564'N	139° 45.123'E	0.0	279.0	279.0	1.0	10.2
31.10.2012	07:33:58	CRA001	AIS	35° 39.564'N	139° 45.123'E	0.0	279.0	279.0	1.1	9.0
31.10.2012	07:32:58	CRA001	AIS	35° 39.564'N	139° 45.123'E	0.0	279.0	279.0	1.2	7.6

19.5.1 How to set the conditions for logging danger targets

The operator may set Closest Point of Arrival (CPA), Time for CPA (TCPA) and Log interval for viewing dangerous TT and AIS targets on the chart radar display.

1. Open the menu and select the [Danger Targets] page from the [Danger Target] menu.



2. Set how often to record dangerous TTs and AIS targets with [Log interval].

20. ALERTS

20.1 Alerts, Alert System

20.1.1 Alert box description

When an alert condition is found, the applicable alert message and alert ID appear in the [Alert] box. For the alarm and warning alerts a buzzer sounds. The [Alert] box is composed of the four items shown in the figure below.

Item	Description
Alert state icon	State of generated alert is shown with an icon.
Alert message	The alert message indication shows the name and ID of the alert having the highest priority. The indication is red for alarm, yellow-orange for warning, and yellow for caution.
Alert list, alert log	Right-click to select Alert List Window or Alert Log Window as appropriate.
Buzzer stop icon	Click to silence buzzer temporarily (30 s). The buzzer sounds again if an alert is not acknowledged.

20.1.2 Alert messages

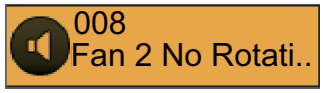
Category of alert and display format

There are three categories of alert messages: alarm, warning and caution. The color of the alert and display format depends on the category of the alert as shown in the table below.

Alarm: Alarms are the most urgent alerts that require your immediate attention. The alert is red and flashes. The buzzer sounds until acknowledged.

Warning: Most alerts are in this category. The color is yellow-orange and they generate a continuous audible alert and flash until acknowledged. If a warning is not acknowledged within 60 seconds then the category changes to alarm.

Caution: Indicate doubtful condition. The color is yellow and the indication is displayed steadily. The caution alert does not generate the beep sound.

Alert format	Priority of alert	Alert state	Display state
 Displayed alternately 	Alarm	- Not acknowledged/Not rectified. OR - Not acknowledged/Rectified.	Flashes every 0.5 s. Black characters on red background Red characters on gray background.
	Alarm	Acknowledged/Not rectified.	Red characters on gray background.
 Displayed alternately 	Warning	- Not acknowledged/Not rectified. OR - Not acknowledged/Rectified.	Flashes every 0.5 s. Black characters on yellow-orange background. Yellow-orange characters on gray background.
	Warning	Acknowledged/Not rectified.	Yellow-orange characters on gray background.
	Caution	Not rectified.	Yellow characters on gray background.
	Alarm/ Warning	Acknowledged/Rectified.	No display.
	Caution	Rectified.	No display.

How to acknowledge an unacknowledged alert message

When the buzzer for an alarm or warning sounds, silence the buzzer by doing one of the following:

- Click the buzzer stop icon in the [Alert] box.
- Press the **ALARM ACK** key.
- In the [Alert] list, click the unacknowledged alarm.

After acknowledgement, the priority of the alert changes as shown in the table below. The buzzer and the flashing for the alert message are stopped and the priority of the alarm changes as shown in the table below. The alert message remains on the display.

Priority no.		Category of alert	Alert state	Priority after acknowledge	Priority after rectifying
High	(1)	Alarm	Not acknowledged/ Not rectified	(3)	No change
			Not acknowledged/ Rectified	(6)	–
	(2)	Warning	Not acknowledged/ Not rectified	(4)	No change
			Not acknowledged/ Rectified	(7)	–
	(3)	Alarm	Acknowledged/ Not rectified	–	(6)
	(4)	Warning	Acknowledged/ Not rectified	–	(7)
	(5)	Caution	Not rectified	–	(8)
	(6)	Alarm	Acknowledged/ Rectified	–	–
	(7)	Warning	Acknowledged/ Rectified	–	–
Low	(8)	Caution	Rectified	–	–

Equipment generating an alert and alert acknowledgement

The equipment generating an alert is divided into three categories, A, B and C. Alert acknowledgement right depends on the equipment generating the alert.

Category	Where the buzzer sounds	Place of alert acknowledgement
A	Equipment that generated the alert.	Equipment that generated the alert.
B	Equipment that generated the alert and AMS.	Equipment that generated the alert and AMS.
C	IAS (Integrated Automation System) generated engine alert.	–

20.1.3 Alert state icons

The alert state icons show the alert status for alarms, warnings, and cautions.

Icon	Alert state	Icon description
Alert type: Alarm		
	Not acknowledged/Not rectified	Red triangle with black loudspeaker in center of triangle. Flashing every 0.5 s.
	Not acknowledged/Not rectified Buzzer temporarily silenced	Red triangle with crossed out black loudspeaker in center of triangle. Flashing every 0.5 s.
	Acknowledged/Not rectified	Red triangle with black exclamation point in center of triangle.
	Not acknowledged/Rectified	Red triangle with black check mark in center of triangle. Flashing every 0.5 s.
Alert type: Warning		
	Not acknowledged/Not rectified	Yellow-orange circle with black loudspeaker in center of circle. Flashing every 0.5 s.
	Not acknowledged/Not rectified Buzzer temporarily silenced	Yellow-orange circle with crossed out black loudspeaker in center of circle. Flashing every 0.5 s.
	Acknowledged/Not rectified	Yellow-orange circle with black exclamation point in center of circle.
	Not acknowledged/Rectified	Yellow-orange circle with black check mark in center of circle. Flashing every 0.5 s.
Alert type: Caution		
	Caution	Steadily displayed yellow square with black exclamation point in center of square.

20.1.4 Buzzer stop icon

The background of the buzzer stop changes according to alert state, as shown in the table below.

Icon state	Description
	No alert generated. The background is grey and the icon is greyed out.
	An alert (alarm, warning, caution) is being acknowledged. The background is grey and the icon is white.
	Icon clicked to silence buzzer temporarily. The background is light-blue and the icon is black.

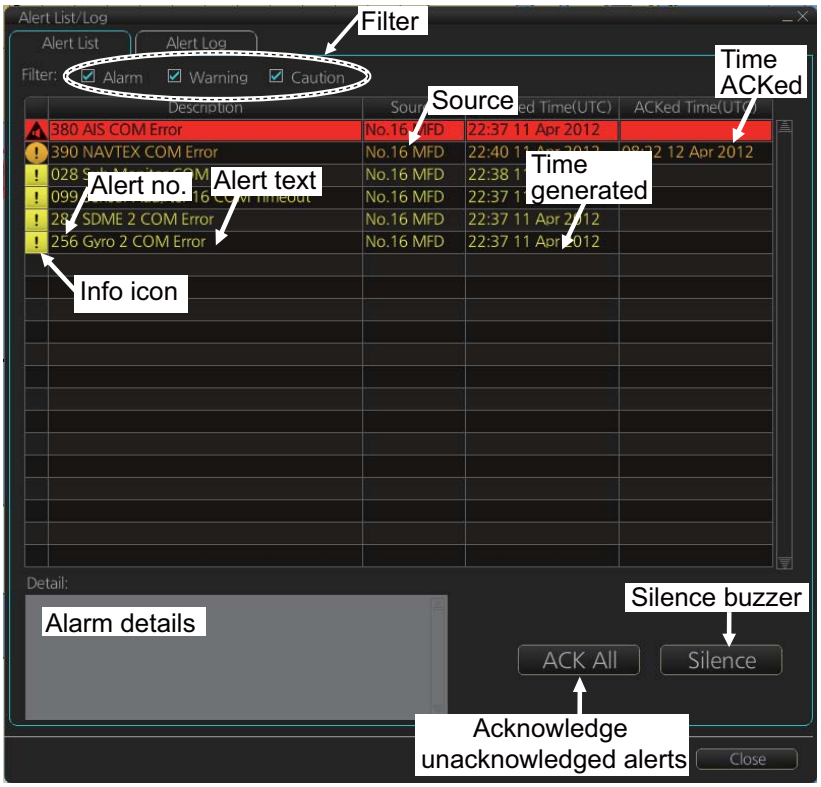
20.2 Alert List

The [Alert List] displays the status of the system alerts, in order of generation, latest to the earliest. To display the list, right-click the Alert list icon in the [Alert] box then select [Alert List Window]. The ZDA sentence is required to display time in the list.

Note: The alert list cannot be opened while the radar is transmitting.

The list shows

- Alert no.
- Alert text
- Source of alert
- Time (UTC) alert was generated
- Time (UTC) alert was acknowledged
- Details about the alerts



The background color of unacknowledged alarms is red (flashing) and unacknowledged warning is yellow-orange (flashing). Acknowledged alarms are displayed steadily in red and acknowledged warnings are in yellow-orange. Cautions are displayed steadily in yellow.

The [Filter] checkboxes at the top of the window let you select what alerts to view. Check or uncheck the boxes to show or hide the corresponding alerts.

To find details about an alert, click the applicable Info icon at the left side of the window to show the details in the [Detail] box at the bottom of the window. The reason for the alert, how to handle the alert, etc. are shown.

An individual alarm or warning can be acknowledged by clicking it. To acknowledge all unacknowledged alarms and warnings, click the [ACK All] button at the bottom of the window.

The [Silence] button temporarily silences the buzzer. An alert remains on the list until the cause for the alert is solved.

How the alert list is updated after acknowledgement, rectifying

When you acknowledge an alert, its display method on the [Alert] list changes according to alert category and alert state. Acknowledged and rectified alerts are immediately removed from the list.

No.	Category of alert	Alert state	Display after acknowledgement	Display after rectifying
1	Alarm	Not acknowledged/ Not rectified	5	2
2		Not acknowledged/ Rectified	8	–
3	Warning	Not acknowledged/ Not rectified	6	4
4		Not acknowledged/ Rectified	9	–
5	Alarm	Acknowledged/ Not rectified	–	8
6	Warning	Acknowledged/ Not rectified	–	9
7	Caution	Not rectified	–	10
8	Alarm	Acknowledged/ Rectified	–	–
9	Warning	Acknowledged/ Rectified	–	–
10	Caution	Rectified	–	–

20.3 Alert Log

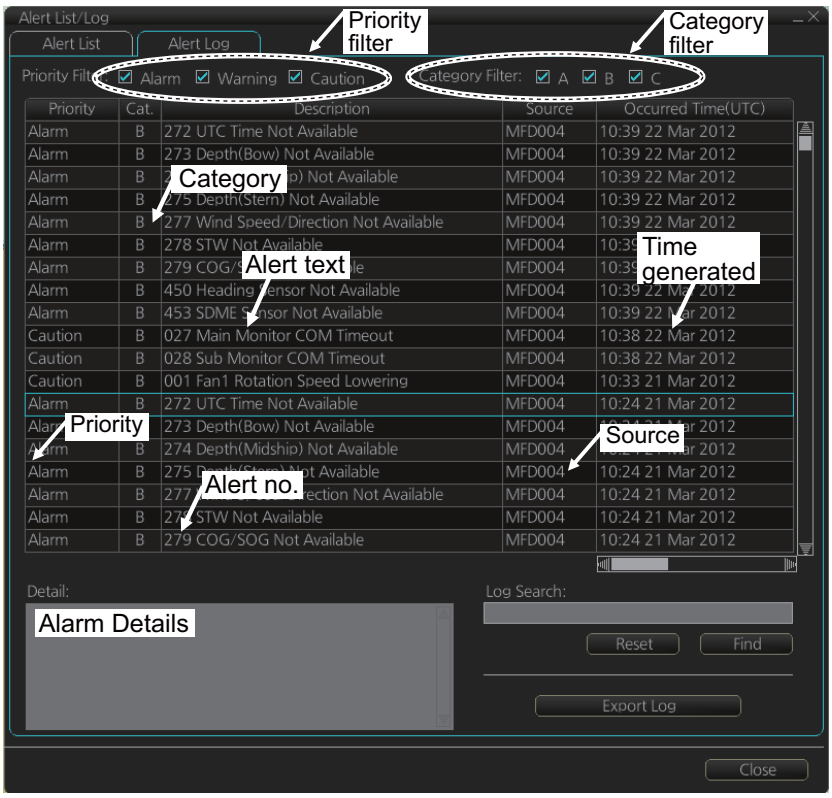
The [Alert] log stores the latest 10,000 alerts and displays the latest 500 alerts. To display the log, right-click the Alert list icon then select [Alert Log Window].

Note: The alert list cannot be opened while the radar is transmitting.

The log shows the following information for each alert:

- Priority of alert (Alarm, Warning, Caution)
- Category of alert (A, B or C)
- Description of alert
- Source of alert
- Occurred Time (UTC)
- ACKed Time (UTC)
- Rectified Time (UTC)

You can select what type of alerts to display with the [Priority] and [Category] filters at the top of the list. The list can be sorted by [Priority], [Cat.], [Description] or [Occurred Time]. Click the corresponding column title to sort. To find detailed information about an alert, select it to show detailed information in the [Detail] box. To search the log, enter text in the [Log Search] box then click the [Find] button. You can save the contents of the log to a USB flash memory, in .dat format, by clicking the [Export Log] button.



20.4 Alert Reception from Connected Sensors

An "ALR receive and ACK transmit" communication is available for every serial line. ALR message from the sensor includes information about alert on sensor. This alert is presented though the normal alert system of this system. When you acknowledge it then an ACK message is sent to the sensor to perform remote acknowledge.

This interface is based on IEC 61162-1 and IEC 80/520/INF.

20.5 List of Alerts

No.	Alert	Category
001	Fan1 Rotation Speed Lowering	Caution
002	Fan2 Rotation Speed Lowering	Caution
003	Fan3 Rotation Speed Lowering	Caution
004	Fan4 Rotation Speed Lowering	Caution
005	LCD Unit Lifetime Over	Warning
006	High Temperature Inside Monitor	Warning
007	Fan1 No Rotation	Warning
008	Fan2 No Rotation	Warning
009	Fan3 No Rotation	Warning
010	Fan4 No Rotation	Warning
011	RS485 Communication Timeout	Caution
012	No Signal	Caution
013	Sentence Syntax Error	Caution
014	Fan1 Rotation Speed Lowering	Caution
015	Fan2 Rotation Speed Lowering	Caution
016	Fan3 Rotation Speed Lowering	Caution
017	Fan4 Rotation Speed Lowering	Warning
018	LCD Unit Lifetime Over	Warning
019	High Temperature Inside Monitor	Warning
020	Fan1 No Rotation	Warning
021	Fan2 No Rotation	Warning
022	Fan3 No Rotation	Warning
023	Fan4 No Rotation	Warning
024	RS485 Communication Timeout	Caution
025	No Signal	Caution
026	Sentence Syntax Error	Caution
027	Main Monitor COM Timeout	Caution
028	Sub Monitor COM Timeout	Caution
030	Sensor Adapter 1 COM Timeout	Caution
031	Sensor Adapter 2 COM Timeout	Caution
032	Sensor Adapter 3 COM Timeout	Caution
033	Sensor Adapter 4 COM Timeout	Caution
034	Sensor Adapter 5 COM Timeout	Caution
035	Sensor Adapter 6 COM Timeout	Caution
036	Sensor Adapter 7 COM Timeout	Caution
037	Sensor Adapter 8 COM Timeout	Caution
038	Sensor Adapter 9 COM Timeout	Caution
039	Sensor Adapter 10 COM Timeout	Caution
070	RCU 1 COM Timeout	Caution
071	RCU 2 COM Timeout	Caution

001-013 Main monitor
014-026 Sub monitor

No.	Alert	Category
072	RCU 3 COM Timeout	Caution
073	EC-3000 CPU Temp High	Caution
074	EC-3000 CPU Temp High	Caution
075	EC-3000 CPU Board Temp High	Caution
076	EC-3000 Remote 1 Temp High	Caution
077	EC-3000 Remote 2 Temp High	Caution
078	EC-3000 CPU Fan Rotation Speed Lowering	Caution
079	EC-3000 Fan1 Rotation Speed Lowering	Caution
080	EC-3000 Fan2 Rotation Speed Lowering	Caution
082	EC-3000 CPU Fan No Rotation	Warning
083	EC-3000 Fan1 Fan No Rotation	Warning
084	EC-3000 Fan2 Fan No Rotation	Warning
086	EC-3000 CPU board 5V Power Error	Warning
087	EC-3000 CPU board 3.3V Power Error	Warning
088	EC-3000 CPU board 12V Power Error	Warning
089	EC-3000 CPU board Battery Power Error	Caution
090	EC-3000 CPU board Core Power Error	Caution
094	Sensor Adapter 11 COM Timeout	Caution
095	Sensor Adapter 12 COM Timeout	Caution
096	Sensor Adapter 13 COM Timeout	Caution
097	Sensor Adapter 14 COM Timeout	Caution
098	Sensor Adapter 15 COM Timeout	Caution
099	Sensor Adapter 16 COM Timeout	Caution
150	Early Course Change Indication	Warning
151	Actual Course Change Indication	Warning
152	Wheel Over Line	Alarm
170	Positioning System Failure	Warning
171	Crossing Safety Contour	Alarm
172	Deviation From Planned Route - Off-Track Alarm	Alarm
175	Different Geodetic Datum	Warning
176	System Malfunction	Warning
235	Echo Sounder 1 COM Error	Caution
236	Echo Sounder 2 COM Error	Caution
237	Echo Sounder 3 COM Error	Caution
255	Gyro 1 COM Error	Caution
256	Gyro 2 COM Error	Caution
257	Gyro 3 COM Error	Caution
258	Gyro 4 COM Error	Caution
259	Gyro 5 COM Error	Caution
272	UTC Time Not Available	Warning
273	Depth(Bow) Not Available	Warning
274	Depth(Midship) Not Available	Warning
275	Depth(Stern) Not Available	Warning
277	Wind Speed/Direction Not Available	Warning
278	STW Not Available	Warning

No.	Alert	Category
279	COG/SOG Not Available	Warning
280	SDME 1 COM Error	Caution
281	SDME 2 COM Error	Caution
282	SDME 3 COM Error	Caution
290	EPFS 1 COM Error	Caution
291	EPFS 2 COM Error	Caution
292	EPFS 3 COM Error	Caution
293	EPFS 4 COM Error	Caution
294	EPFS 5 COM Error	Caution
295	EPFS 6 COM Error	Caution
296	EPFS 7 COM Error	Caution
297	EPFS 8 COM Error	Caution
298	EPFS 9 COM Error	Caution
310	Other Sensor 1 COM Error	Caution
311	Other Sensor 2 COM Error	Caution
312	Other Sensor 3 COM Error	Caution
313	Other Sensor 4 COM Error	Caution
314	Other Sensor 5 COM Error	Caution
315	Other Sensor 6 COM Error	Caution
316	Other Sensor 7 COM Error	Caution
317	Other Sensor 8 COM Error	Caution
318	Other Sensor 9 COM Error	Caution
319	Other Sensor 10 COM Error	Caution
320	EC-3000 Ch.01 COM Timeout	Caution
321	EC-3000 Ch.02 COM Timeout	Caution
322	EC-3000 Ch.03 COM Timeout	Caution
323	EC-3000 Ch.04 COM Timeout	Caution
324	EC-3000 Ch.05 COM Timeout	Caution
325	EC-3000 Ch.06 COM Timeout	Caution
326	EC-3000 Ch.07 COM Timeout	Caution
327	EC-3000 Ch.08 COM Timeout	Caution
330	Sensor Adapter Ch.01 COM Timeout	Caution
331	Sensor Adapter Ch.02 COM Timeout	Caution
332	Sensor Adapter Ch.03 COM Timeout	Caution
333	Sensor Adapter Ch.04 COM Timeout	Caution
334	Sensor Adapter Ch.05 COM Timeout	Caution
335	Sensor Adapter Ch.06 COM Timeout	Caution
336	Sensor Adapter Ch.07 COM Timeout	Caution
337	Sensor Adapter Ch.08 COM Timeout	Caution
360	Wind Sensor 1 COM Error	Caution
361	Wind Sensor 2 COM Error	Caution
362	Wind Sensor 3 COM Error	Caution

No.	Alert	Category
370	Water Current COM Error	Warning
371	Water Temp COM Error	Warning
380	AIS COM Error	Warning
390	NAVTEX COM Error	Warning
400	Network Printer Not Available	Caution
401	Local Printer Not Available	Caution
450	Heading Sensor Not Available	Warning
451	Gyro CORR. Source Change	Caution
453	SDME Sensor Not Available	Warning
469	WGS84 Not Used	Warning
470	Datum Change	Caution
471	Position Source Change	Caution
485	Depth Limit	Alarm
495	Anchor Watch Error	Warning
500	Watch Alert	Warning
520	TT System Error	Warning
521	TT New Target	Warning
522	TT Auto ACQ 95%	Caution
523	TT Auto ACQ 100%	Warning
524	TT MAN ACQ 95%	Caution
525	TT MAN ACQ 100%	Warning
526	TT CPA/TCPA	Alarm
527	TT Lost	Warning
528	REF Target Lost	Warning
529	AIS New Target	Warning
530	AIS Target Display 95%	Caution
531	AIS Target Display 100%	Warning
532	AIS Target Capacity 95%	Caution
533	AIS Target Capacity 100%	Warning
534	AIS Target Activate 95%	Caution
535	AIS Target Activate 100%	Warning
536	AIS CPA/TCPA	Alarm
537	AIS Lost	Warning
539	AIS Message Received	Caution
541	AIS Message Transmit Error	Caution
542	AIS Transmitting	Caution
543	No CPA/TCPA for AIS	Warning
560	Association	Caution
620	User Chart Danger Area	Warning
621	Traffic Separation Zone	Warning
622	Inshore Traffic Zone	Warning
623	Restricted Area	Warning

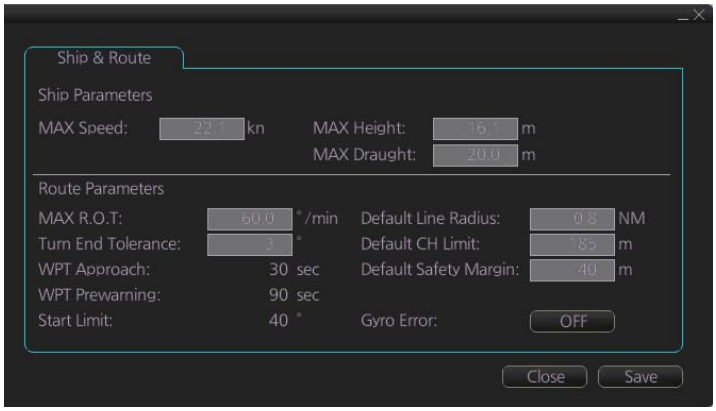
No.	Alert	Category
624	Caution Area	Warning
625	Offshore Production Area	Warning
626	Military Practice Area	Warning
627	Seaplane Landing Area	Warning
628	Submarine Transit Lane	Warning
629	Anchorage Area	Warning
630	Marine Farm / Aquaculture	Warning
631	PSSA Area	Warning
633	Buoy	Warning
634	UKC Limit	Warning
635	No Official Data	Warning
640	Chartalign: Over 30 min	Caution
720	No ANT Heading Signal	Warning
721	No ANT Azimuth Signal	Warning
722	No ANT Trigger Signal	Warning
723	No ANT Video Signal	Warning
724	No RPU Gyro Signal	Warning
726	RF Unit COM Error	Warning
727	Radar Processor COM Error	Warning
728	Radar Processor SW Version Error	Warning
730	EXT Radar STBY	Caution
740	EXT Radar No Signal	Warning
750	EXT Radar COM Error	Warning

21. PARAMETERS

21.1 Ship and Route Parameters

The purpose of the ship and route parameters is set the basic parameters for the ship. These parameters are relative to ship steering and they are very important to get correct function of the integrated navigation system. They must be maintained carefully. Modification requires a good knowledge of the parameters' importance.

Open the menu and select [Ship & Route Parameters] from the [General] menu to show the [Ship & Route] page. Set each item referring to the description below.



Ship parameters description

MAX Speed: Maximum speed the ship can do.
MAX Height: Max. height of ship above sea level.
MAX Draught: Max. draught of ship.

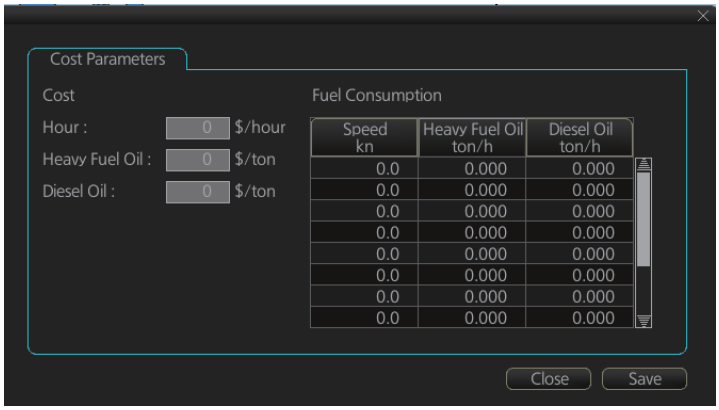
Route parameters description

MAX R.O.T.: Indicate the maximum rate of turn of the ship.
Turn End Tolerance: Define the window for the detection of the end of turn. Typical values are between 2 to 4 degrees.
WPT Approach*: Set the alert time before reaching the wheel over point.
WPT Prewarning*: Set the alert time before reaching the wheel over point. It should be well in advance of the WPT approach alert time.
Start Limit*: Set the maximum acceptable approach angle against planned course to start automatic route steering.
Default Line Radius: Define the default value of radius between waypoints during automatic route steering.
Default CH Limit: Define the default value of channel limit.
Default Safety Margin: Define the default value of extension for channel to be checked against selected alerts.
Gyro Error: Enable/disable the gyro error compensation of set course during automatic route steering.
* Protected with password/key protection

21.2 Cost Parameters

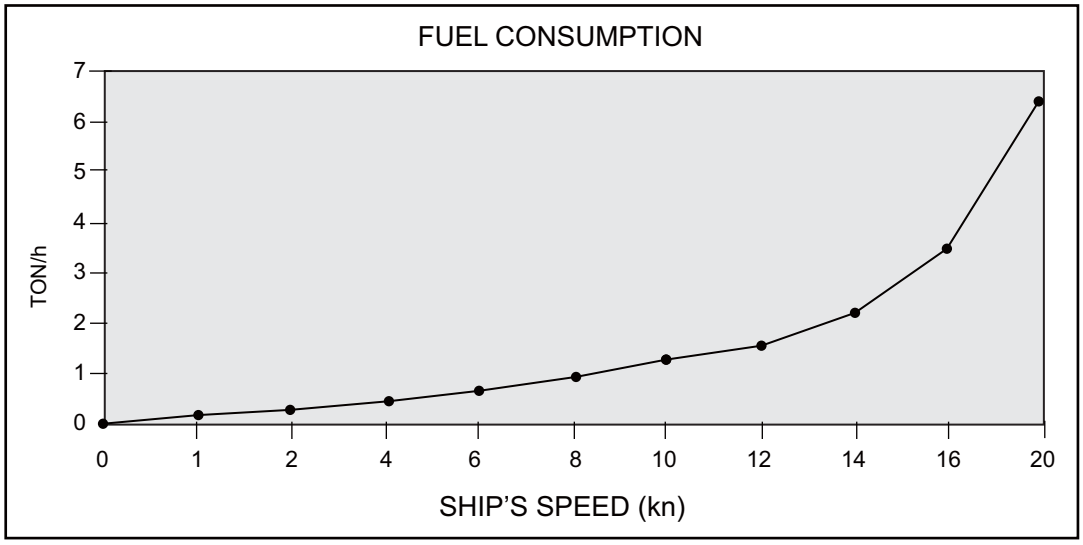
The cost parameters are used in the optimization calculation. Therefore define these parameters before doing the calculation.

Open the menu and select [Cost Parameters] from the [General] menu to show the [Cost Parameters] page. Set each item according to ship's plan, etc.



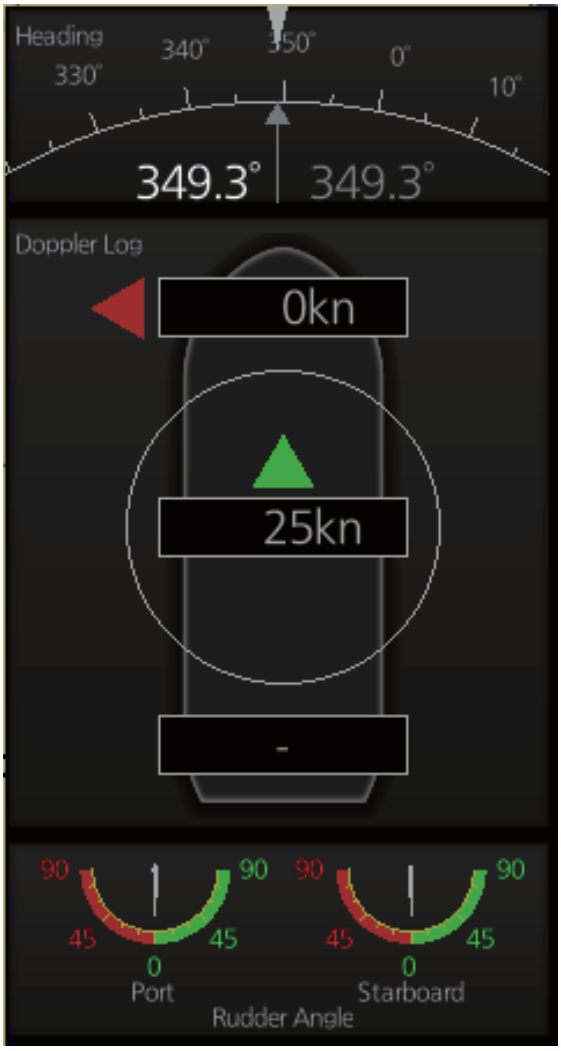
At the [Cost] window, enter the cost/hour and cost/ton for heavy fuel oil and diesel oil.

At the [Fuel Consumption] window, define the fuel consumption figures for up to 12 different speeds. Before entering the data, plot the data on a graph, like the one shown below. Use a second graph if, for example, diesel oil consumption is different from that of heavy fuel oil.



22. MINI CONNING DISPLAY

The mini conning display, available in the Voyage navigation mode, provides heading, doppler log speed and rudder angle information. To show the mini conning display, click the [Mini Conning] button on the InstantAccess bar.



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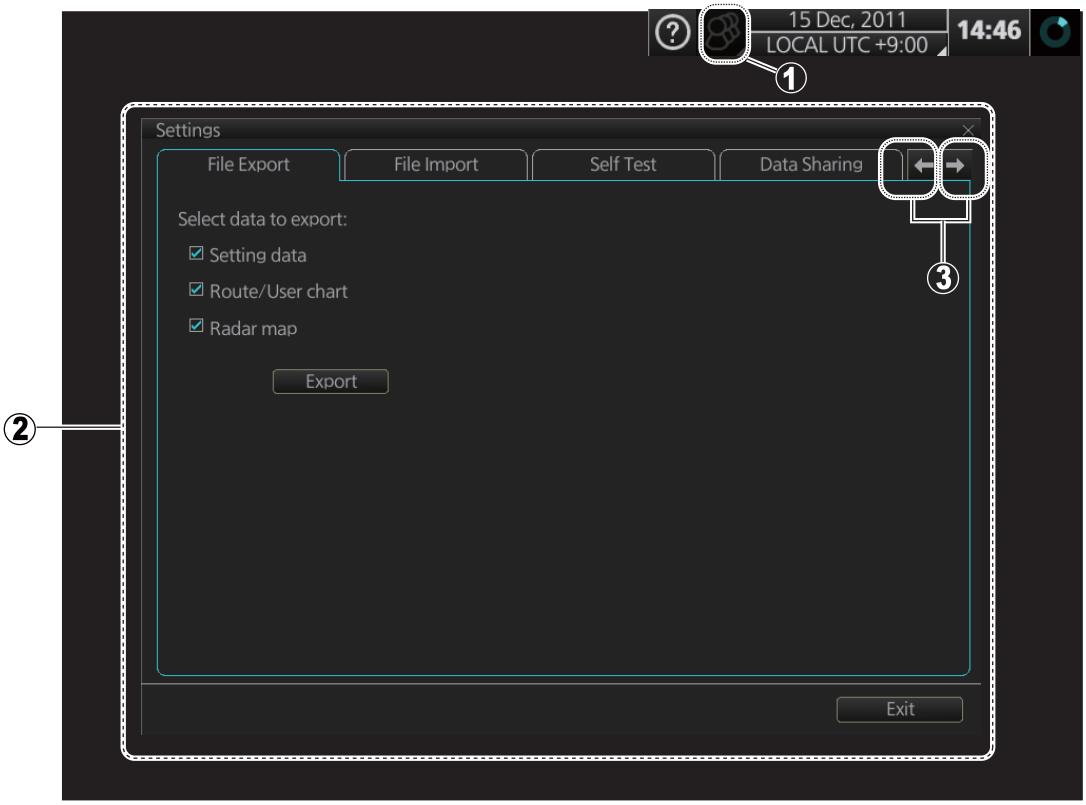
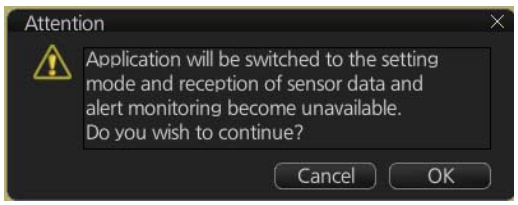
23. SETTINGS MENU

The [Settings] menu provides file import and export, testing facilities (display, keyboard, self test), customizing, screen shot processing, and CCRP selection.

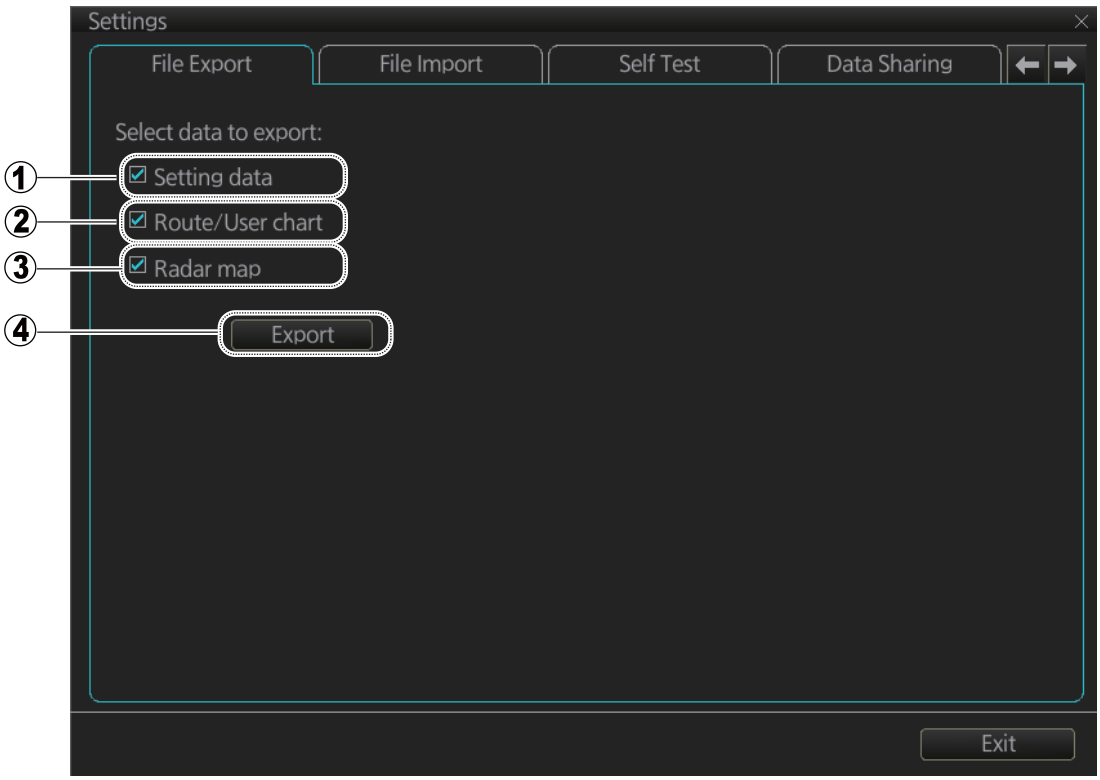
23.1 How to Access the Settings Menu



No.	Name	Description
1	 ([Settings] menu access button)	Click the button then select [Settings] to access the [Settings] menu. The message shown below appears. Click the [OK] button to open the [Settings] menu. 
2	[Settings] menu display area	The [Settings] menus appear here.
3	Page selection buttons	To open a page, use the page selection buttons to select a page then click the tab of the page desired. The color of the border of the page selected is light blue.

23.2 File Export

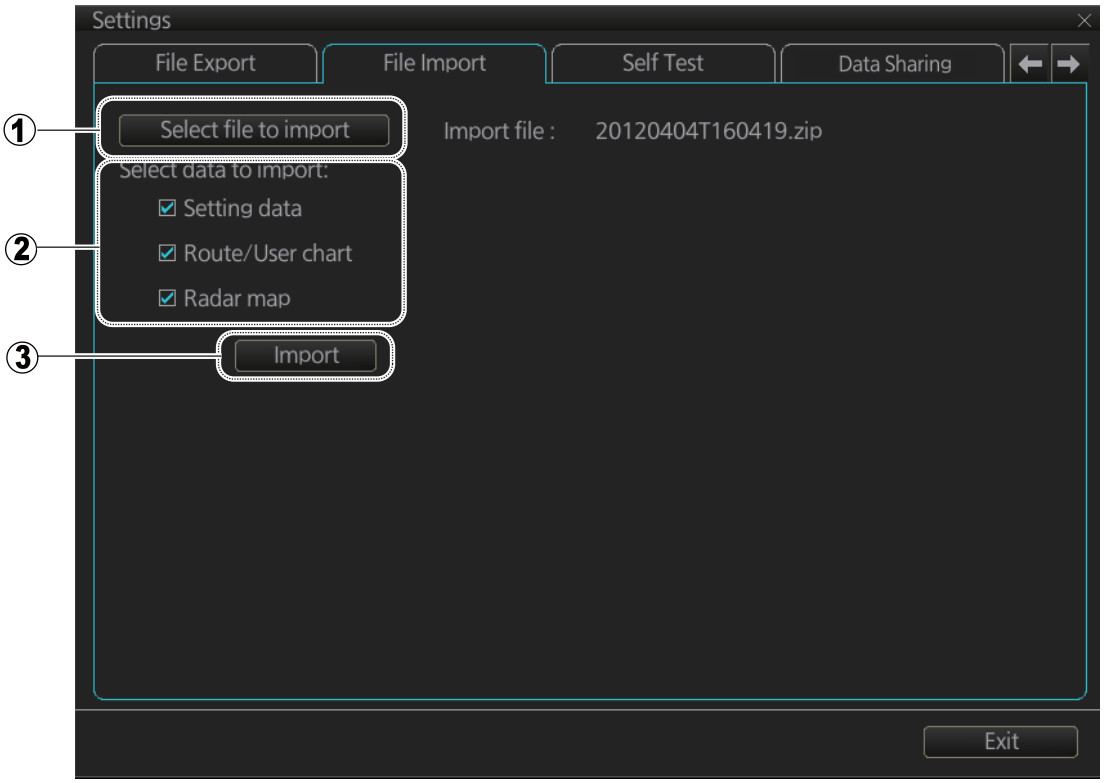
The [File Export] page lets you export setting data, routes, user charts and radar maps to a USB flash memory, in .zip file format.



No.	Name	Description
1	Setting data	Check to export setting data (radar, chart, conning, common, performance monitor data) and ten user profile data.
2	Route/User chart	Check to export all routes and user charts.
3	Radar map	Check to export all radar maps.
4	Export	Click to export all selected objects.

23.3 File Import

The [File Import] page lets you import setting data, routes, user charts and radar maps from an external media (USB flash memory, etc.).



No.	Name	Description
1	Select file to import button	Click to show the [OPEN FILE] dialog box, where you can select the file to import.
2	Select data to import	Check the data to import, among setting data, routes, user charts and radar maps.
3	[Import] button	Click to import the objects selected. A message indicating importing in progress appears on the display.

Note 1: The system automatically restarts if setting data is imported.

Note 2: If importing could not be completed, first check if the USB flash memory is correctly inserted. If it is correctly inserted, try importing again.

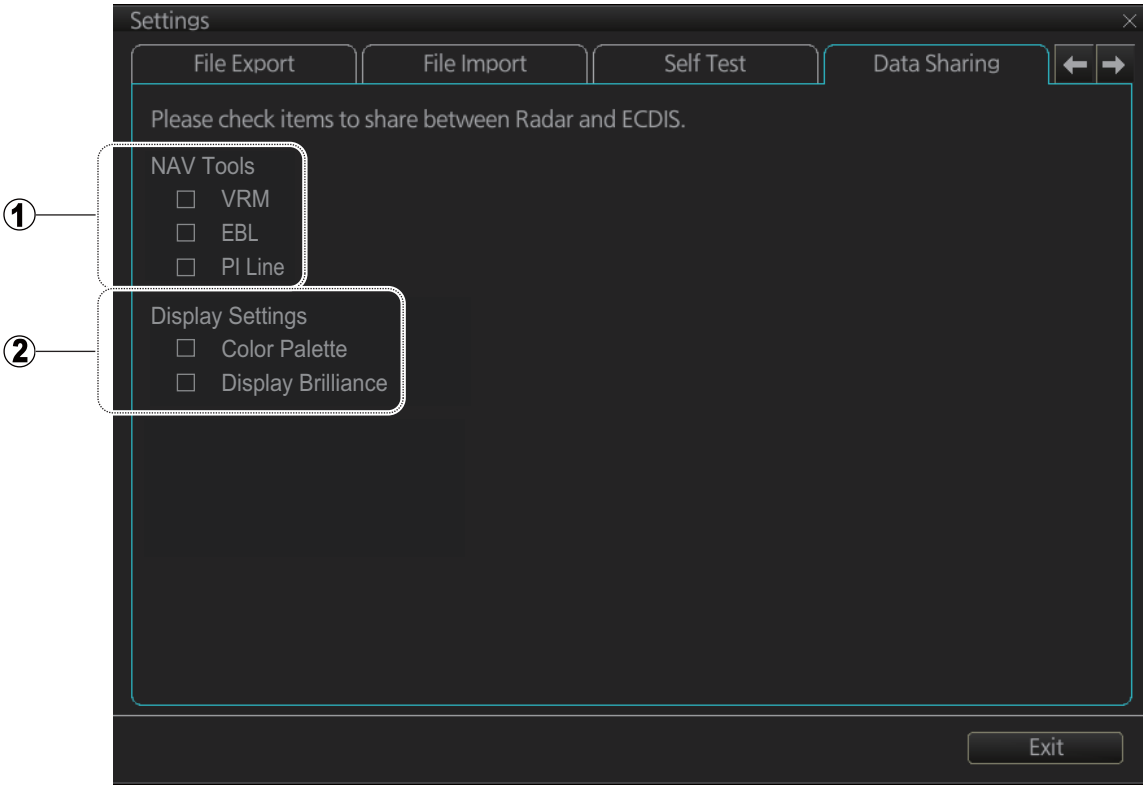
23.4 Self Test

The [Self Test] page mainly runs a loopback test to check the Processor Unit EC-3000 for proper operation. The fan and DVD drive in the Processor Unit are also checked. The chart radar is inoperative during the test.

No.	Name	Description
1	Test results, program numbers	The results of the self test and the program numbers. (xx=version number)
2	[Start] button	Start the self test.
3	[Stop] button	Stop the self test. (Shown during test.)

23.5 Data Sharing

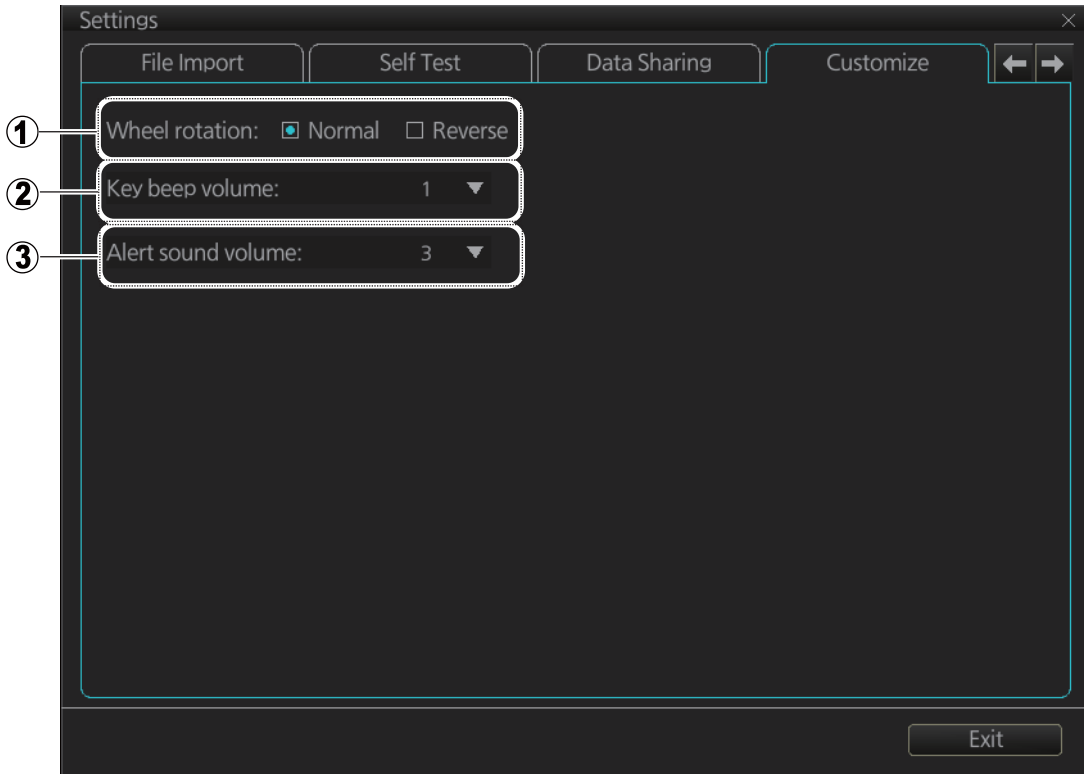
The [Data Sharing] page selects the items to share between the radar and the chart radar.



No.	Name	Description
1	NAV Tools	Check the NAV tools items to share them between the chart and the radar.
2	Display Settings	Check the display setting items to share between the chart and the radar.

23.6 Customize

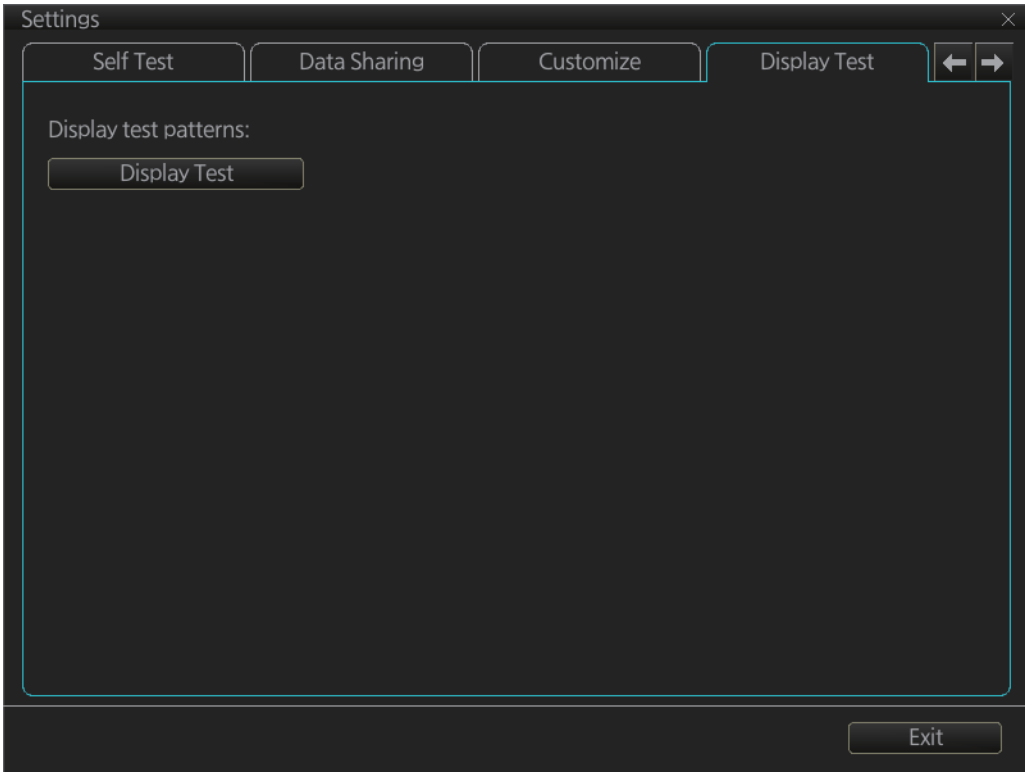
The [Customize] page lets you set buzzer volume, key beep volume, and scrollwheel rotation direction.



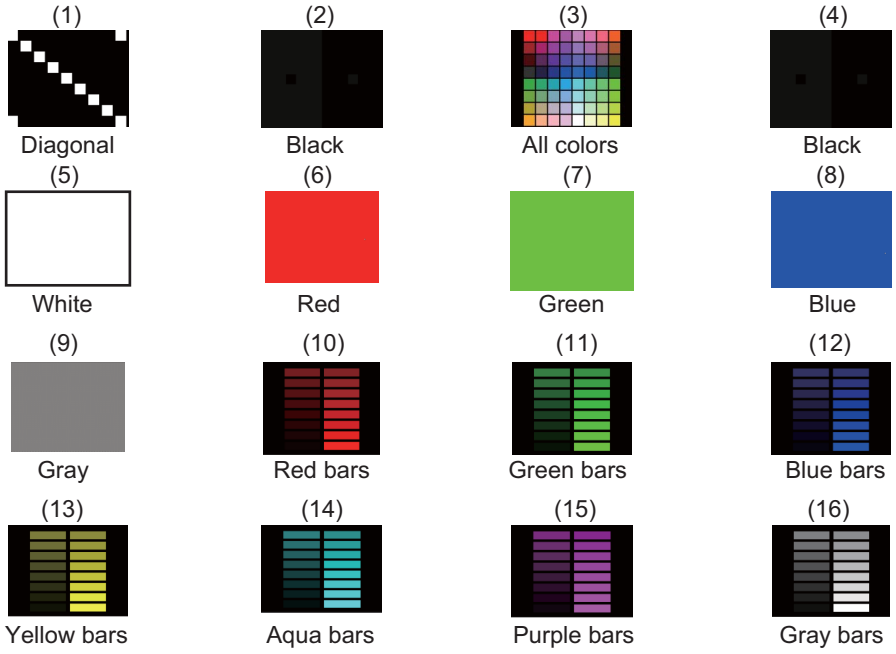
No.	Name	Description
1	Wheel rotation	Set the direction of scrollwheel rotation direction. **Normal:** Downward to increase value, upward to decrease value. **Reverse:** Reverse of "Normal".
2	Key beep volume	Set the loudness of the key beep that sounds for correct key operation on Control Unit and mouse buttons. 0, no beep, 1, LOW; 2, MID; 3, HIGH
3	Alert sound volume	Set the loudness of the alert buzzer. 1, LOW; 2, MID; 3, HIGH

23.7 Display Test

The [DIsplay Test] page displays various test patterns to check the FURUNO-supplied monitor for proper display of colors. Click the [Display Test] button to start the test.



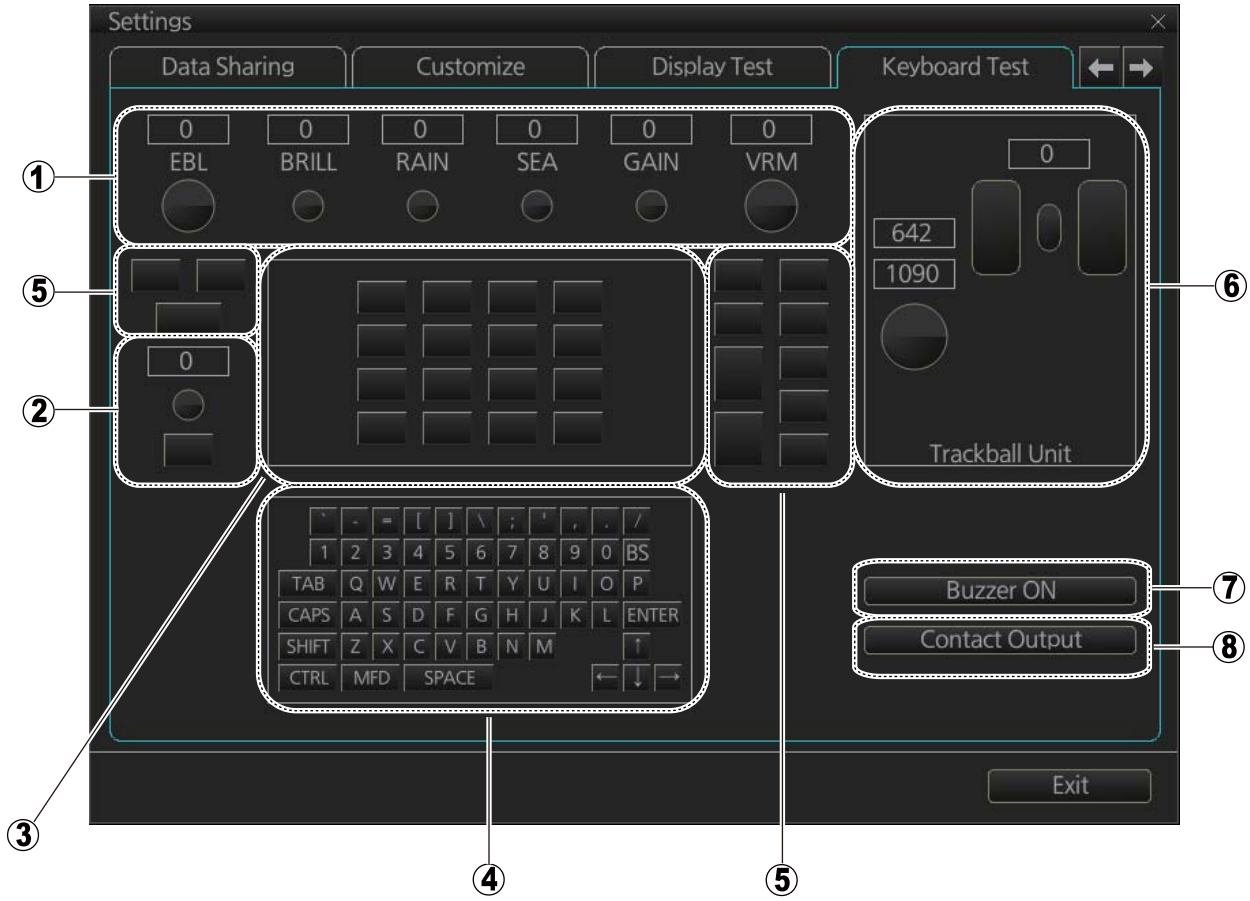
Left-click to proceed in the numerical order shown below; right-click to proceed in reverse order.



To quit the display test at any time, press the **ESC** key on the applicable Control Unit.

23.8 Keyboard Test

The [Keyboard Test] page checks the controls and keys on the Radar Control Unit and the ECDIS Control Unit and the trackball module on the Radar Control Unit, ECDIS Control Unit and Trackball Control Unit.

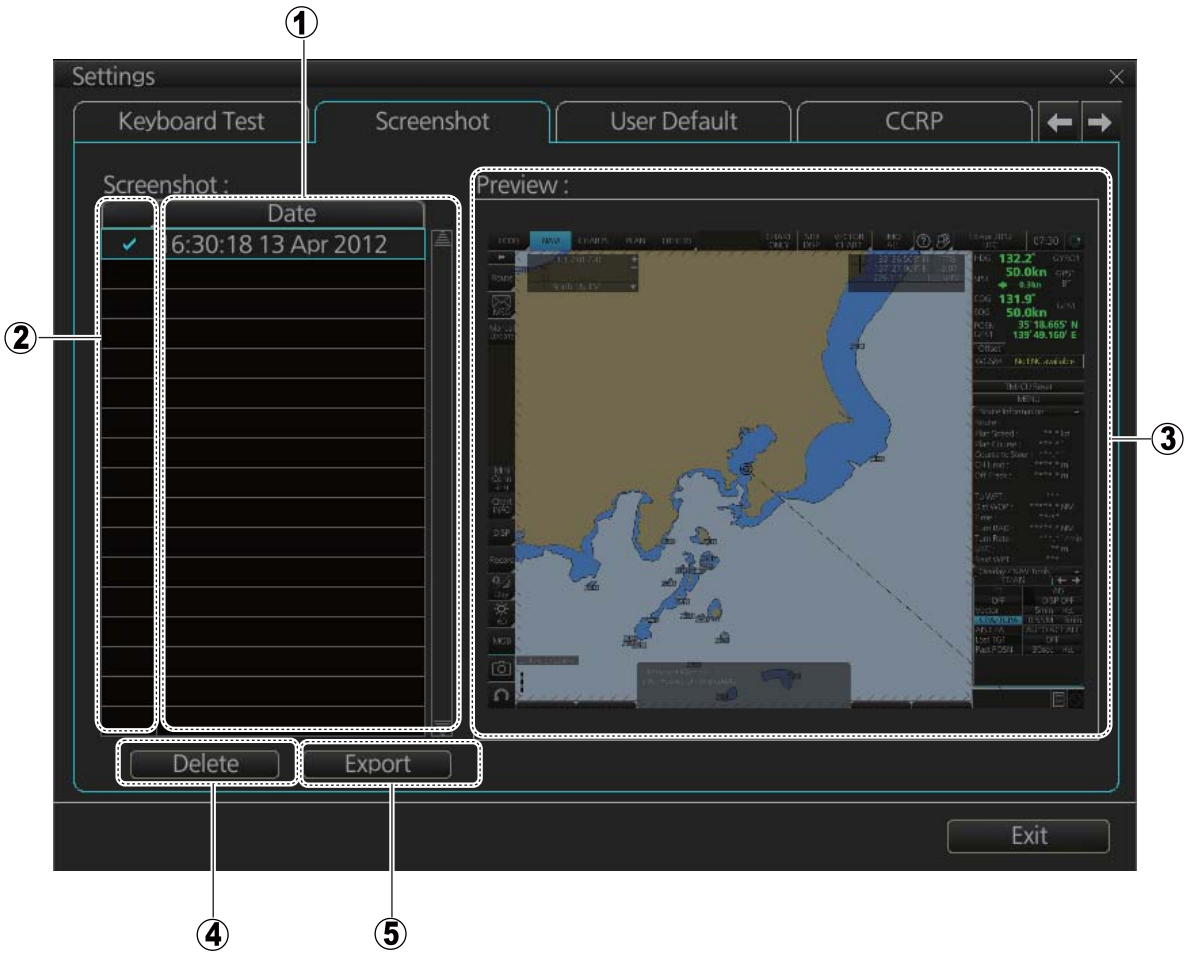


No.	Name	Description
1	Common controls	Operate the corresponding controls on the Radar Control Unit and ECDIS Control Unit. Rotate a control and the window above the control shows the setting value. Push a control and the corresponding location on screen lights in light blue. (The RAIN and SEA controls are inoperative on the ECDIS Control Unit. The EBL and VRM controls do not have a push function.).
2	InstantAccess knob/key	Check the **InstantAccess** knob and key. 1) Rotate the knob and the setting value appears in the window. 2) Push the knob and the knob lights in light blue. 3) Push the key and the key lights in blue.
3	Keys of the Radar Control Unit	Operate each key. The key pressed lights in light blue.
4	Keyboard of the ECDIS Control Unit	Operate each key. The key pressed lights in light blue.

No.	Name	Description
5	Keys of both the Radar Control Unit and ECDIS Control Unit	Operate each key. The pressed key lights in light blue.
6	Trackball module	Check the trackball module of a Control Unit: 1) Spin the scrollwheel and rotate the trackball. The indication above the operated control shows the setting value. 2) Push each button. The window above a pushed button lights in light blue. 3) Push the scrollwheel. The window above the wheel lights in light blue.
7	[Buzzer ON] button	Click the [Buzzer ON] button to sound the buzzer. The buzzer sounds and the button flashes (in red). Click the button again to cancel.
8	[Contact Output] button	Click the [Contact Output] button to output the System Failure contact signal from the Processor Unit. Click the button again to cancel.

23.9 Screenshots

The [Screenshot] page handles the exporting (to a USB flash memory) and deleting of screenshots from the SSD.



No.	Name	Description
1	List	List of screenshots taken. Screenshots are automatically assigned a file name consisting of the time and date the screenshot was taken.
2	Check boxes	Put a checkmark in the box of the screenshot to process.
3	Preview	Preview of the screenshot selected.
4	[Delete] button	Delete the screenshot(s) selected.
5	[Export] button	Export selected screenshot(s) to a USB flash memory.

23.9.1 How to export screenshots

You can export screenshots to a USB flash memory as follows:

1. Insert a USB flash memory in a USB port on the Control Unit.
2. Open the [Screenshot] page.
3. Put a checkmark in the checkbox of the screenshot(s) to export.
4. Click the [Export] button.

5. Select the USB flash memory.
6. Click the [OK] button to export the screenshots selected.

23.9.2 How to delete screenshots

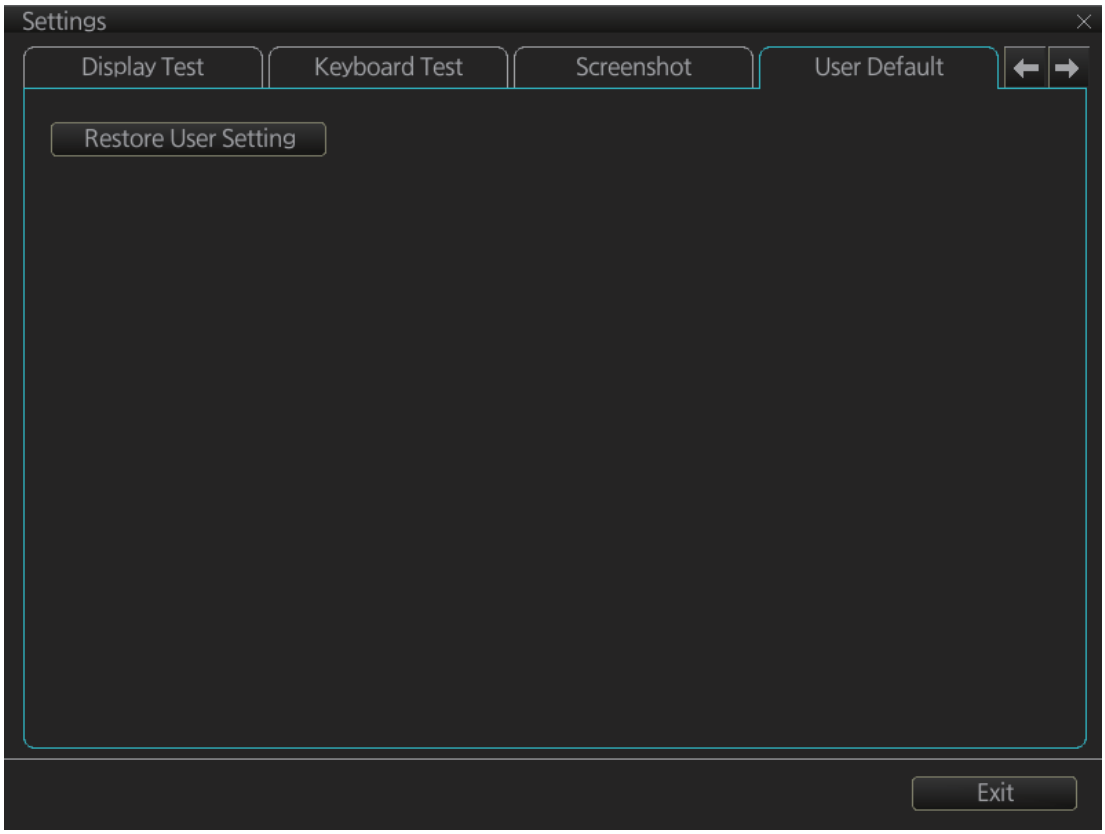
1. Select the [Screenshot] page.
2. Put a checkmark in the checkbox of the screenshot(s) to delete. To select all screenshots, right-click the box to the left of the [Date] column then select [Select all]. To clear all check marks, select [Clear all].
3. Click the [Delete] button. You are asked "Selected files will be deleted. Do you want to continue?"
4. Click the [OK] button to delete the screenshots selected.

23.10 User Default

The [User Default] page restores all default settings for the [Chart Display] and [Symbol Display]. Click the [Restore User Setting] button. The power is reset after the default settings are restored.

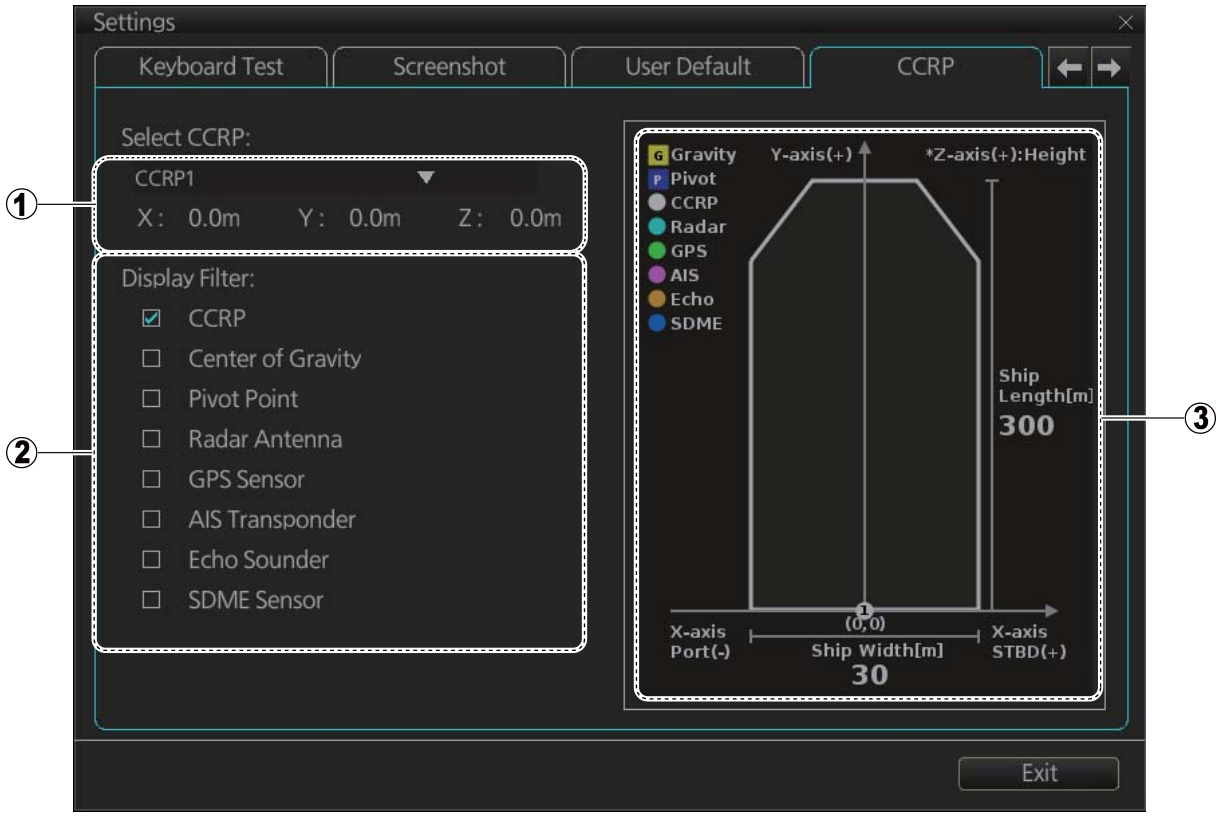
If you require the settings shown below, copy them to a USB flash memory (using the file export feature), BEFORE restoring user defaults.

- Setting data
- Route/User chart
- Radar map



23.11 CCRP

The [CCRP] page provides for selection of CCRP (Consistent Common Reference Point) and shows the location of various sensors.



No.	Name	Description
1	CCRP	Select the CCRP to use in the case of multiple CCRPs.
2	Display Filter	Check the items to show on the ship's graphic.
3	Ship's graphic	Shows the location of the sensors selected at the [Display Filter].

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24. COMMON REFERENCE SYSTEM

24.1 Installation of the System

Special attention of following topics is required to maintain the "Common Reference System." The origin of the common reference system is the conning position on vessel.

- The values of the center and conning positions depend on the size and geometry of the ship.
- Offsets from the antenna position to the conning position of position sensors depend on the location of the antennas of the position sensor.
- Offsets from the antenna position to the conning position of the radars depend on the location of the radar antennas.

24.2 Accuracy of the System

Accuracy depends on the following conditions:

- Gyro error referenced to chart orientation
- Accuracy of EPFS
- Accuracy of radar performance and display (see the specifications at the back of this manual).
- Accuracy of setting of CCRP (see section 2.30.

The following items must be properly adjusted to meet the above conditions:

- Timing (Tx timing of radar echo). The procedure for adjustment is shown in "Adjustment sweep timing" in the Installation Manual.
- Heading (Adjustment of radar echo heading). The procedure for adjustment is shown in "Heading alignment" in the Installation Manual.
- Radar ANT position (Center of radar image is the radar antenna position). Radar antenna position is input in the "Common Installation Setting" menu.
- Conning position:
  - The chart radar uses position data fed from a GPS navigator to calculate the latitude and longitude position of the conning position.
  - GPS antenna position and conning position are entered in the "Common Installation Setting" menu to calculate offset.
  - The latitude and longitude position displayed at the top-right position on the screen is the latitude and longitude position of the conning position.
  - The chart datum used by the chart radar is recorded in geodetic datum WGS-84; therefore, the geodetic datum setting on the GPS navigator must be WGS-84.
- Gyro data:
  - Serial format gyro data is fed directly from a gyrocompass, thus adjustment of the heading indication on the chart radar is not necessary.

- If synchro or stepper gyro data is fed to the chart radar, the heading indication on the chart radar must be adjusted to match that of the gyro. For the adjustment procedure, see section 1.15.

- Speed data:
  - Speed may be input from SDME or GPS.
  - SDME may be single-axis water speed or dual-axis ground speed.
  - GPS may be used to input COG/SOG.
  - Ground speed may also be taken from TT reference target.
  - Speed is entered from the “Sensor Setting” menu. For details, see section 1.14.

25. MAINTENANCE AND TROUBLE-SHOOTING

Periodic checks and maintenance are important for proper operation of any electronic system. This chapter contains maintenance and troubleshooting instructions to be followed to obtain optimum performance and the longest possible life of the equipment. Before attempting any maintenance or troubleshooting procedure please review the safety information below. If you cannot restore normal operation after following the troubleshooting procedures, do not attempt to check inside any unit; there are no user-serviceable parts inside. Refer any repair work to a qualified technician.

⚠ WARNING

Do not open the equipment.

Hazardous voltage which can cause electrical shock exists inside the equipment. Only qualified personnel should work inside the equipment.

Turn off the radar power switch before servicing the antenna unit. Post a warning sign near the switch indicating it should not be turned on while the antenna unit is being serviced.

Prevent the potential risk of being struck by the rotating antenna.

A transmitting radar antenna emits electromagnetic waves, which can be harmful, particularly the eyes.

Wear a safety belt and hard hat when working on the antenna unit.

Serious injury or death can result if someone falls from the radar antenna mast.

NOTICE

Do not apply paint, anti-corrosive sealant or contact spray to coating or plastic parts of the equipment.

Those items contain organic solvents that can damage coating and plastic parts, especially plastic connectors.

25.1 Maintenance

Regular maintenance is essential to good performance. A regular maintenance program should be established and should at least include the items shown in the table below.

Maintenance schedule

Interval	Check point	Check and measures	Remarks
When needed	FURUNO-supplied monitor unit and Processor Units	Dust or dirt may be removed from a cabinet with a soft cloth. Water-diluted mild detergent may be used if desired. DO NOT use chemical cleaners to clean the display unit; they may remove paint and markings. To clean the LCD, wipe the LCD carefully to prevent scratching, using tissue paper and an LCD cleaner. To remove dirt or salt deposits, use an LCD cleaner, wiping slowly with tissue paper so as to dissolve the dirt or salt. Change paper frequently so the salt or dirt will not scratch the LCD. Do not use solvents such as thinner, acetone or benzene for cleaning. Also, do not use a degreaser or an antifog solution, as they can strip the coating from the LCD.	Do not use chemical-based cleaners for cleaning. They can remove paint and markings.
	Filter inside Processor Unit	Have a technician clean the filter if it is dusty. See section 25.4.	

Interval	Check point	Check and measures	Remarks
3 to 6 months	Cabling	Check that all cabling is firmly connected and is not damaged.	
	Exposed bolts and nuts of antenna unit	Exposed bolts and nuts are subject to corrosion. Further, they may loosen by vibration.	Check that bolts and nuts are not corroded and are securely fastened. If corroded, clean and coat with anticorrosive sealant.
	Radiator	Dust, dirt and salt deposits on the radiator cause signal attenuation, resulting in loss of sensitivity. Wipe radiator with a freshwater-moistened cloth.	The radiator is made of fiberglass reinforced plastic. Therefore, do not used gasoline, benzene and the like to clean the radiator. If the radiator is iced, use a wooden or plastic headed hammer to remove the ice. DO NOT use a steel hammer.
	Terminals, connectors	Check that all terminals and connectors on circuit boards are securely fastened.	Have a qualified technician check terminals and connectors.
6 months to 1 year	Screws on terminal boards in Processor Units	Check that all screws are tightly fastened.	Have a qualified technician check screws.

25.2 How to Replace the Fuses

The fuse in the radar Processor Unit, Processor Unit, monitor unit and sensor adapter protects those units from overvoltage (overcurrent) and internal fault. If a unit cannot be turned on, check if its a fuse has blown. If it has blown, find out the cause before replacing the fuse. If it blows again after replacement, contact your dealer for advice.

⚠ WARNING

Use the proper fuse.

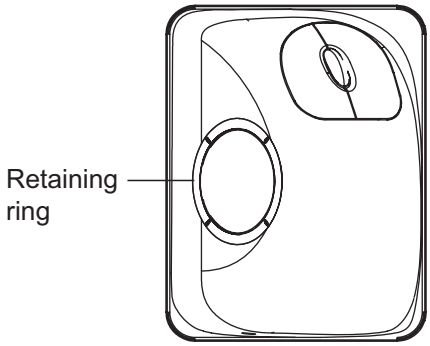
Use of a wrong fuse can damage the equipment or cause fire.

Unit	Power supply	Type	Code no.
Radar Processor Unit RPU-013	100-115 VAC	FGBO 125V 10A PBF	000-155-826-10
	220-230 VAC	FGBO 250V 5A PBF	000-155-840-10
Monitor Unit MU-190	100-230 VAC	FGBO 250V 1A PBF	000-155-828-10
Monitor Unit MU-231	100-230 VAC	FGBO 250V 1.5A PBF	000-155-833-10
Processor Unit EC-3000	100-115 VAC	FGMB 125V 10A PBF	000-157-470-10
	220-230 VAC	FGMB 250V 5A PBF	000-157-570-10
Sensor Adapter MC-3000S	24 VDC	FGMB 125V 3A PBF	000-157-481-10

25.3 Trackball Maintenance

If the cursor moves abnormally, dust or dirt may be on the trackball. Clean the trackball as shown below.

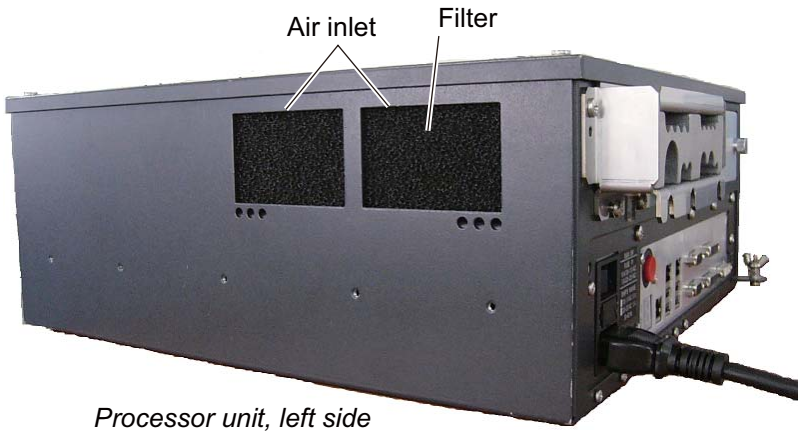
1. Turn the retaining ring on the trackball module counterclockwise 45° to unlock it.



2. Remove the retaining ring and ball.
3. Clean the ball with a soft, lint-free cloth. Blow carefully into the ball-cage to dislodge dust and lint.
4. Look for a build-up of dirt on the metal rollers. If dirty, clean the rollers using a cotton swab moistened lightly with isopropyl-rubbing alcohol.
5. Make sure that fluff from the swab is not left on the rollers.
6. Re-set the ball and retaining ring. Be sure the retaining ring is not inserted reversely.

25.4 How to Clean the Filter in the Processor Unit

Have a qualified technician clean the air inlet filter in the Processor Unit when it becomes dusty. Remove the filter and clean it with water and a mild detergent. Rinse the filter, allow it filter to dry then return it to the Processor Unit.



Processor unit, left side

Note 1: Be sure the air inlet is not blocked. A blocked inlet can cause the temperature to rise inside the cabinet, which can lead to malfunction.

Note 2: The right side of the Processor Unit has an exhaust vent. Remove dust from the vent as necessary.

25.5 Troubleshooting

The troubleshooting table below provides common faults and the remedy with which to restore normal operation.

Radar troubleshooting

If…	then…	Remedy
the radar echoes disappear and the alert 727 "Radar Processor COM Error" appears	check the connection between the EC-3000 and RPU-013.	Reconnect the cable (if loosened) then reset the power.
the power cannot be turned on	• power connector may have loosened. • ship's mains is off. • fuse has blown.	• Check connector. • Check ship's mains. • Replace fuse.
the power can be turned on but nothing appears on the display	• brilliance is too low. • the ambient temperature is less than 0° (32°F).	• Adjust brilliance. • The heater is warming the chart Processor Unit. The display appears in approx. 10 minutes.
key doesn't beep when operated	• key beep is turned off.	• Turn on key beep from the menu.
Picture not updated or picture freeze.	• If the picture freezes, the buzzer sounds and the Status LED blinks in red.	• Turn the power off and on again.
marks and noise appear but no echoes	• fuse may have blown.	• Check fuse in Processor Units.
picture does not change even though range is changed.	• suspect faulty range key or video freeze.	• Hit the **RANGE** key several times. If nothing happens, turn the power on or off again.
only two index lines are displayed	• check index line interval setting.	• Refer to section 2.20.2 for how to adjust index line interval.
range rings are not displayed	• range rings are turned off.	• Turn on the range rings.
tracked target is not tracked correctly	• sea surface reflections, etc. are masking tracked target.	• Adjust **A/C SEA** and **A/C RAIN** to suppress sea and rain clutters.
sensitivity is poor	• suspect 2nd trace echo or soiled radiator.	• Reject 2nd trace echo; clean radiator.

Chart troubleshooting

If…	then…	Remedy
the message "No connection to dongle" appears	• dongle is not connected to USB port.	• Reinsert dongle.
monitored route is not displayed	• route has not been selected. • monitor route has not been selected to be visible above the chart.	• Select route to monitor. • Open the [Route] page of the [Symbol Display] menu and check the monitored route parts to show.
planned route is not displayed	• route has not been selected. • planned route has not been selected to be visible above the chart.	• Select route as “planned”. • Open [Route] page of [Symbol Display] menu and check the planned route parts to show.
symbol of user chart cannot be erased	• two or more symbols may be superimposed on each other.	• Do the delete action several times.
position cannot be found	• position sensor(s) is not selected on the [POSN] page. • position sensor is turned off. • sensor cable has loosened.	• Check position sensor selections. • Turn on position sensor. • Check cable.
S57 chart cannot be displayed	• No ENC chart for area. • Dongle not inserted.	• Open S57 chart from [Manage Charts] dialog box • Connect dongle.
past track is not displayed	• past track is not selected to be visible.	• Open [Tracking] page of [Symbol Display] menu and select [Own Ship Past Tracks] to [Primary] or [Secondary] as appropriate.
monitored user chart is not displayed on ECDIS display	• user chart is not selected to be visible.	• Open [Mariner] page of [Symbol Display] menu and select parts to show.
user chart is not displayed on radar display	• user chart is not selected in Voyage navigation mode.	• Select user chart in Voyage navigation mode.
the message "Nearing memory usage limit. Click the Restart button to restart the system to prevent trouble." appears	• the memory usage limit for software is close to capacity. Performance may be affected.	If you need to save your work, click the [Later] button then reset the power. If you don't need to save your work, click the [Restart] button.
the message "Memory usage limit reached. Click the Restart button to restart the system to prevent trouble." appears	• the memory usage limit for software is reached. Performance may be affected.	Cick the [Restart] button to reset the power. No other operations are available other than restart.
both the operating mode buttons [RADAR] and [CHART for RADAR] are yellow	• the memory usage limit for software is close to capacity. Performance may be affected.	Stop all operations and reset the power.

25.6 Consumable Parts

The table below lists the consumable parts in the antenna unit, Monitor Units, Processor Unit and Sensor Adapters. Replace the parts before their expected expirations.

Consumable parts

Part	Type	Life	Remarks
Antenna Unit			
Antenna motor	D8G-516 (24 rpm, X-band) D8G-571 (42 rpm, X-band) RM-7398 (21/26 rpm, S-band) RM-7435 (21/26 rpm, S-band) RM-9519 (45 rpm, S-band) RM-9520 (45 rpm, S-band)	Gear motor 10,000 hours	
Carbon brush	MG120-5X6X11 D8G (X-band)	10,000 hours	Check for wear when replacing magnetron. Replace if worn.
Magnetron	RTR-078A: MAF1565N (X-band, 12 kW)	5,000 hours	Check no. of hours used at TX time. Reset time after replacement.
	MG5436 (X-band, 25 kW)	5,000 hours	
	MG5223F (S-band, 30 kW)	7,000 hours	
Monitor Unit			
BEZEL (19) & LCD ASSEMBLY	MU-190	50,000 hours	
BEZEL (23) & LCD ASSEMBLY	MU-231	50,000 hours	
Processor Unit EC-3000			
CPU Fan	109R0612G429	8.5 years	
Power Fan	109P0612H761	8.5 years	
Chassis Fan	109P0612H761	8.5 years	
Sensor Adapter MC-3000S			
MC-CS Board	24P0114	8.5 years	
Sensor Adapter MC-3010A			
MC-ANLG Board	24P0115	7.0 years	

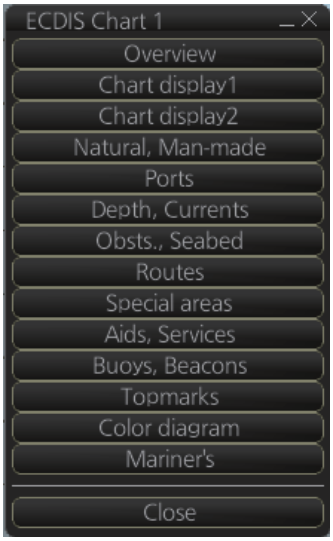
The expected life figures are typical values. Actual life depends on usage and ambient temperature.

25.7 Color Differentiation Test for S57 Charts

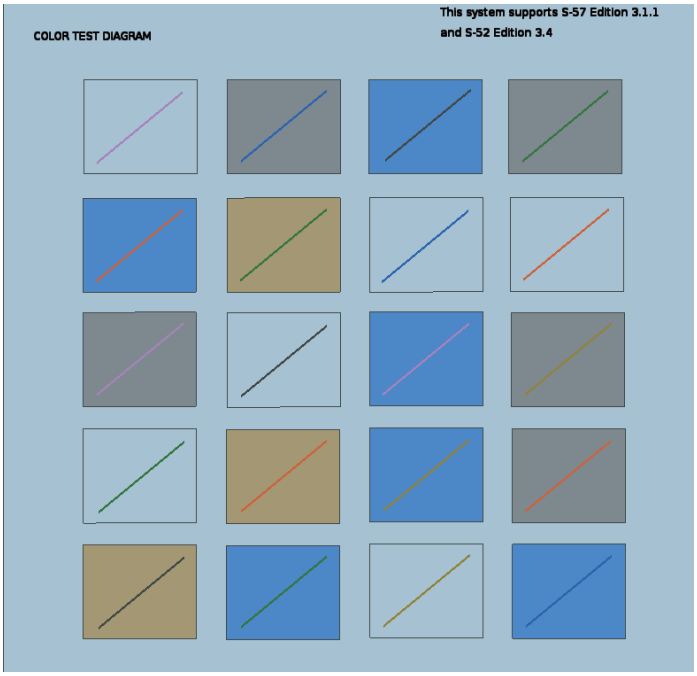
Proper color differentiation is necessary on S57 charts so the operator can confirm that the monitor can distinguish between the various color-coded areas, lines and symbols.

The color differentiation test diagram is a part of ECDIS Chart 1 and you can use it as follows:

1. Click the [Chart INFO] and [Chart 1] buttons on the InstantAccess bar to show the [ECDIS Chart 1] menu.



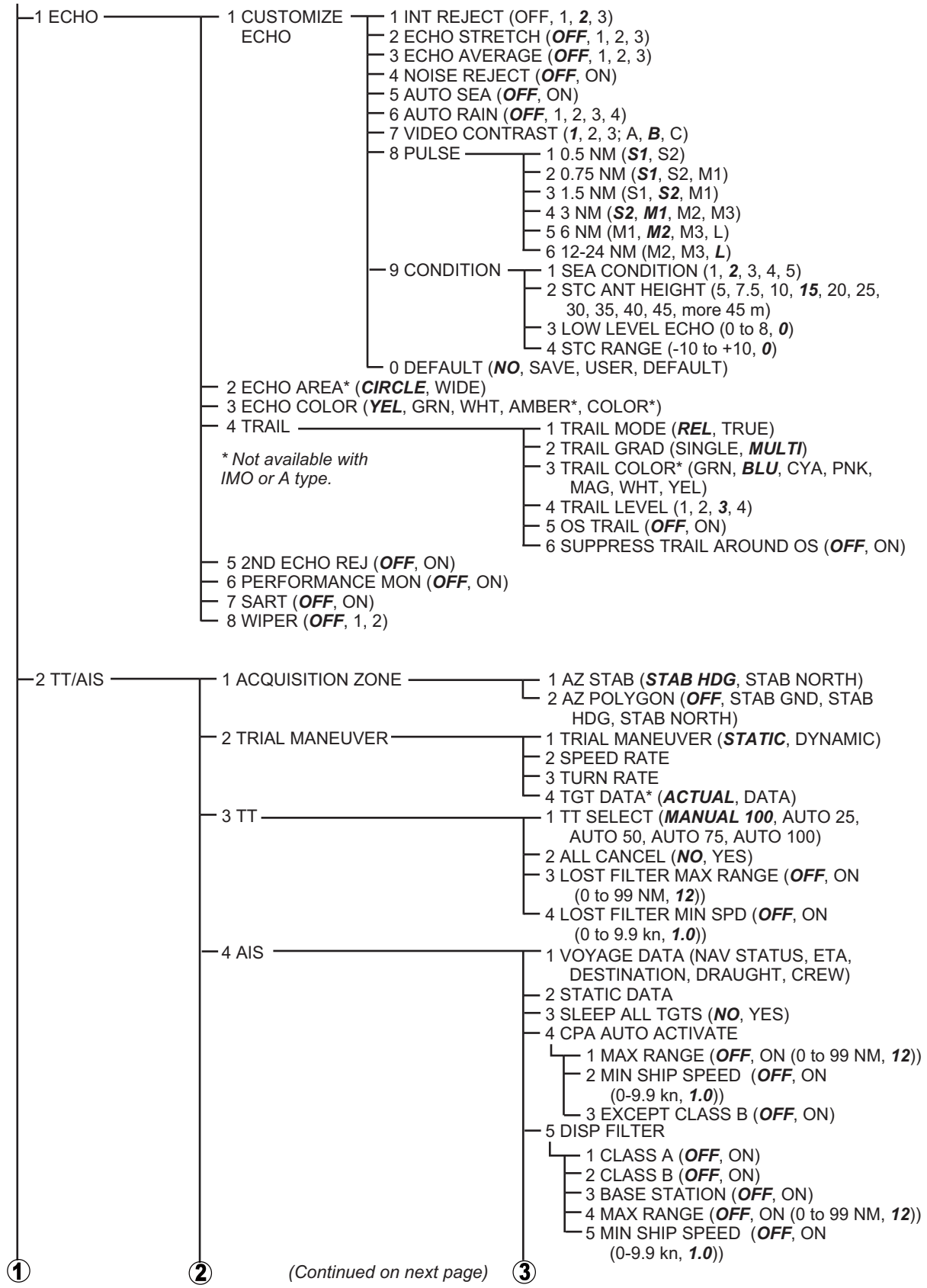
2. Click [Color diagram] to show the color test diagram.



If the colors are correct, the diagonal line will be distinguishable from its surroundings, at any brilliance setting.

APPENDIX 1 MENU TREE

Radar menu



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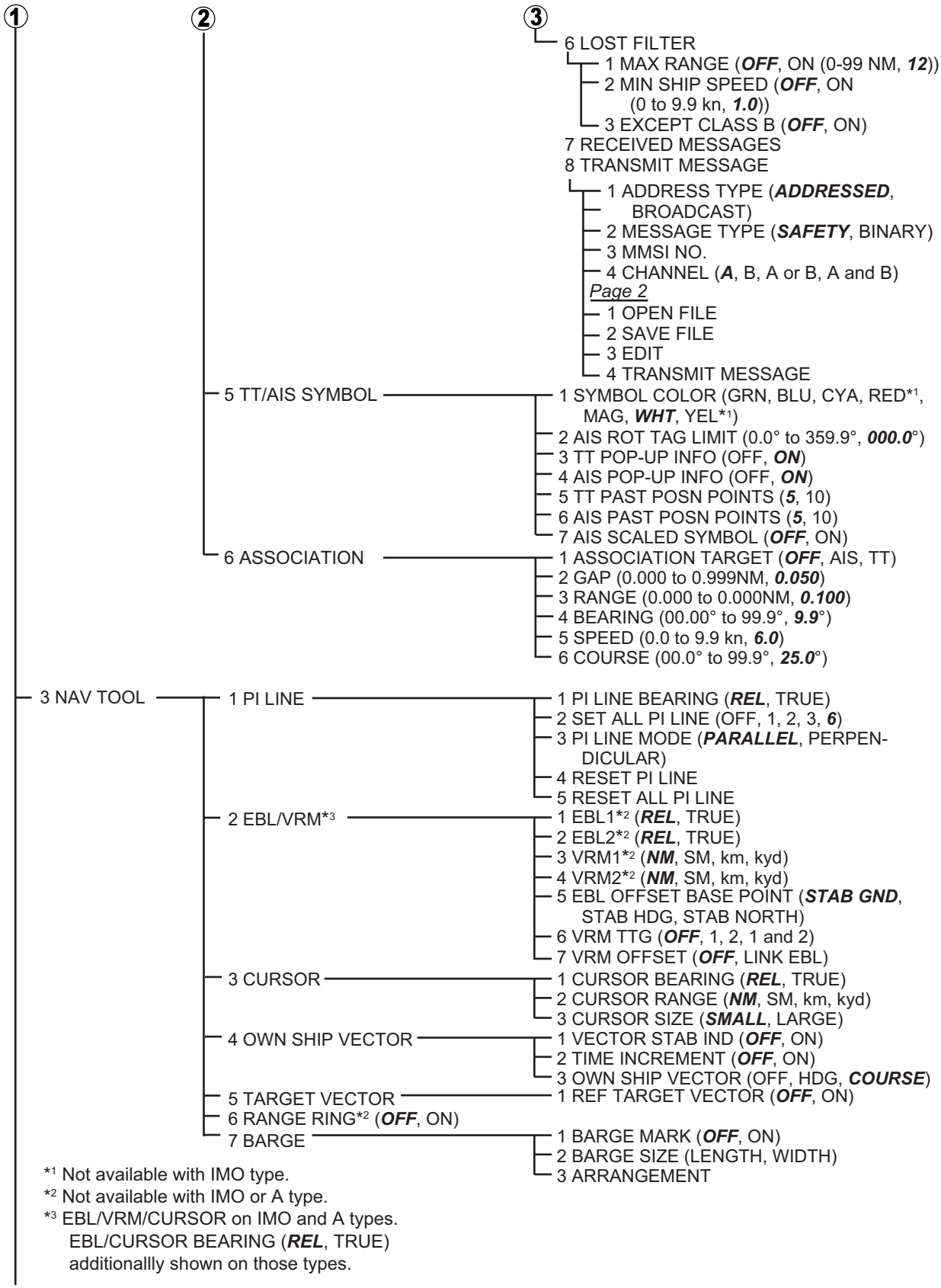
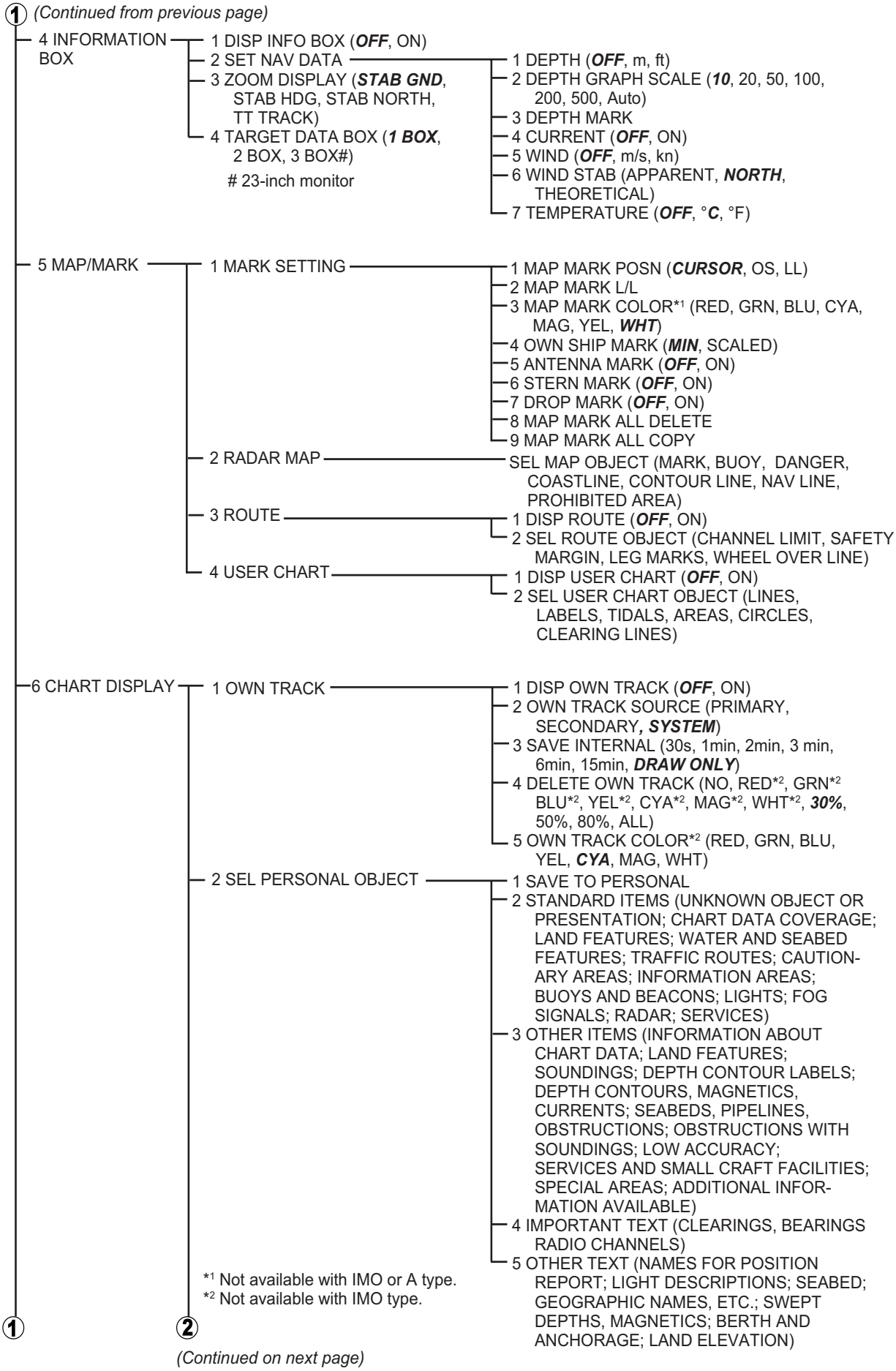


*1 Not available with IMO type.
*2 Not available with IMO or A type.
*3 EBL/VRM/CURSOR on IMO and A types.
EBL/CURSOR BEARING (**REL**, TRUE) additionallly shown on those types.

(Continued on next page)


① (Continued from previous page)
4 INFORMATION BOX
1 DISP INFO BOX (OFF, ON)
2 SET NAV DATA
1 DEPTH (OFF, m, ft)
2 DEPTH GRAPH SCALE (10, 20, 50, 100, 200, 500, Auto)
3 DEPTH MARK
4 CURRENT (OFF, ON)
5 WIND (OFF, m/s, kn)
6 WIND STAB (APPARENT, NORTH, THEORETICAL)
7 TEMPERATURE (OFF, °C, °F)
3 ZOOM DISPLAY (STAB GND, STAB HDG, STAB NORTH, TT TRACK)
4 TARGET DATA BOX (1 BOX, 2 BOX, 3 BOX#)
23-inch monitor
5 MAP/MARK
1 MARK SETTING
1 MAP MARK POSN (CURSOR, OS, LL)
2 MAP MARK L/L
3 MAP MARK COLOR*1 (RED, GRN, BLU, CYA, MAG, YEL, WHT)
4 OWN SHIP MARK (MIN, SCALED)
5 ANTENNA MARK (OFF, ON)
6 STERN MARK (OFF, ON)
7 DROP MARK (OFF, ON)
8 MAP MARK ALL DELETE
9 MAP MARK ALL COPY
2 RADAR MAP
SEL MAP OBJECT (MARK, BUOY, DANGER, COASTLINE, CONTOUR LINE, NAV LINE, PROHIBITED AREA)
3 ROUTE
1 DISP ROUTE (OFF, ON)
2 SEL ROUTE OBJECT (CHANNEL LIMIT, SAFETY MARGIN, LEG MARKS, WHEEL OVER LINE)
4 USER CHART
1 DISP USER CHART (OFF, ON)
2 SEL USER CHART OBJECT (LINES, LABELS, TIDALS, AREAS, CIRCLES, CLEARING LINES)
6 CHART DISPLAY
1 OWN TRACK
1 DISP OWN TRACK (OFF, ON)
2 OWN TRACK SOURCE (PRIMARY, SECONDARY, SYSTEM)
3 SAVE INTERNAL (30s, 1min, 2min, 3 min, 6min, 15min, DRAW ONLY)
4 DELETE OWN TRACK (NO, RED*2, GRN*2 BLU*2, YEL*2, CYA*2, MAG*2, WHT*2, 30%, 50%, 80%, ALL)
5 OWN TRACK COLOR*2 (RED, GRN, BLU, YEL, CYA, MAG, WHT)
2 SEL PERSONAL OBJECT
1 SAVE TO PERSONAL
2 STANDARD ITEMS (UNKNOWN OBJECT OR PRESENTATION; CHART DATA COVERAGE; LAND FEATURES; WATER AND SEABED FEATURES; TRAFFIC ROUTES; CAUTIONARY AREAS; INFORMATION AREAS; BUOYS AND BEACONS; LIGHTS; FOG SIGNALS; RADAR; SERVICES)
3 OTHER ITEMS (INFORMATION ABOUT CHART DATA; LAND FEATURES; SOUNDINGS; DEPTH CONTOUR LABELS; DEPTH CONTOURS, MAGNETICS, CURRENTS; SEABEDS, PIPELINES, OBSTRUCTIONS; OBSTRUCTIONS WITH SOUNDINGS; LOW ACCURACY; SERVICES AND SMALL CRAFT FACILITIES; SPECIAL AREAS; ADDITIONAL INFORMATION AVAILABLE)
4 IMPORTANT TEXT (CLEARINGS, BEARINGS RADIO CHANNELS)
5 OTHER TEXT (NAMES FOR POSITION REPORT; LIGHT DESCRIPTIONS; SEABED; GEOGRAPHIC NAMES, ETC.; SWEPT DEPTHS, MAGNETICS; BERTH AND ANCHORAGE; LAND ELEVATION)
*1 Not available with IMO or A type.
*2 Not available with IMO type.
① ②
(Continued on next page)

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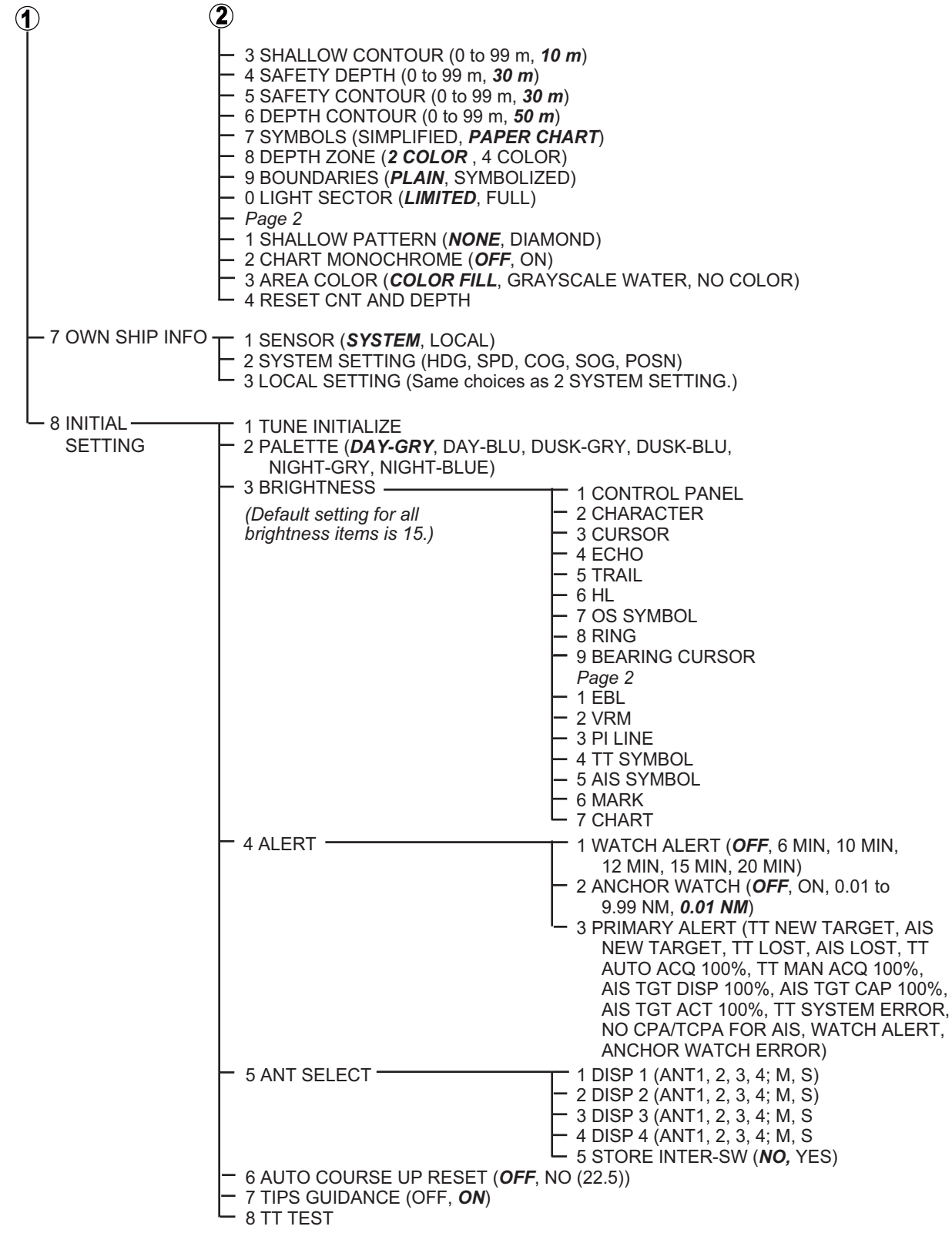
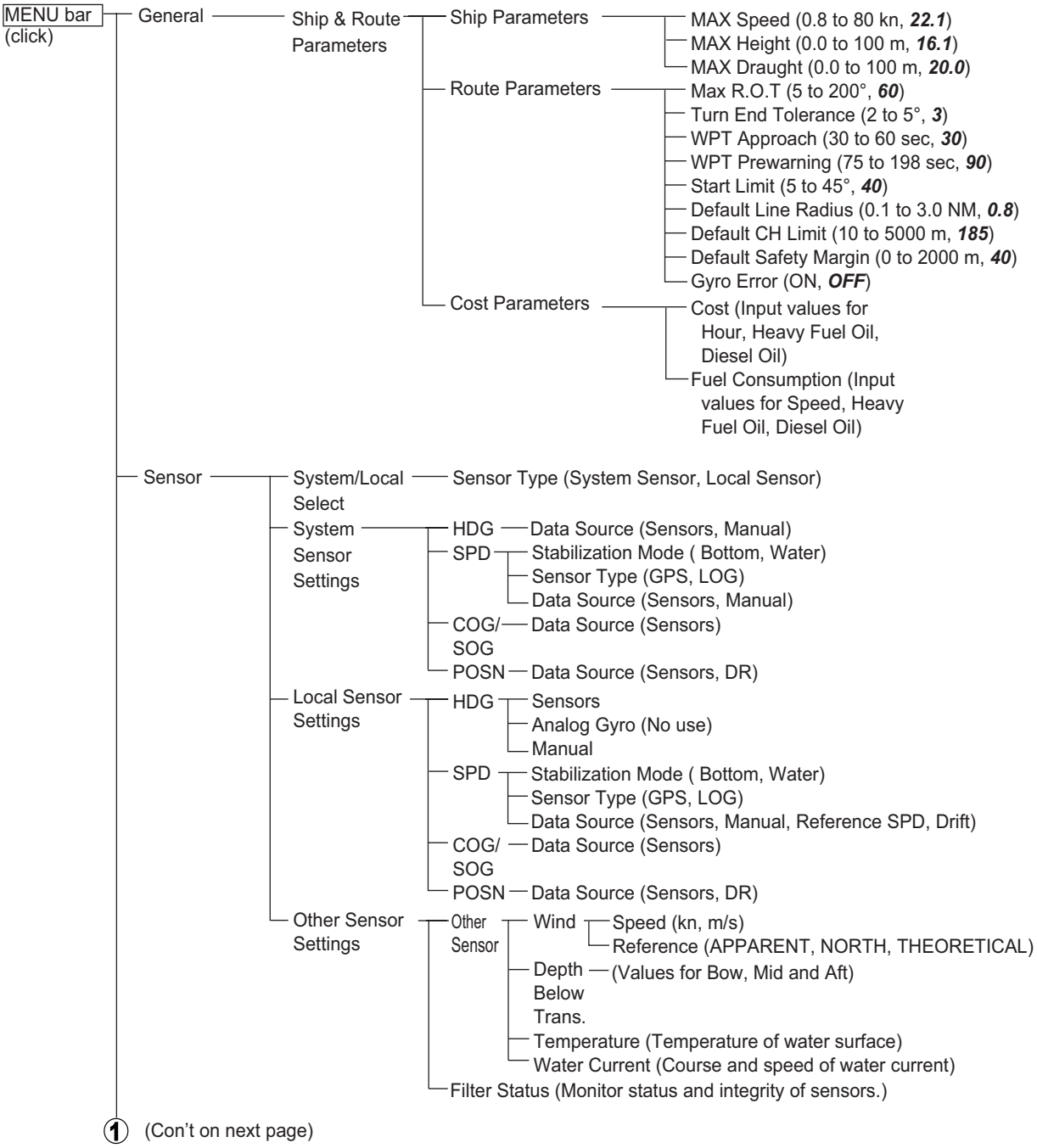
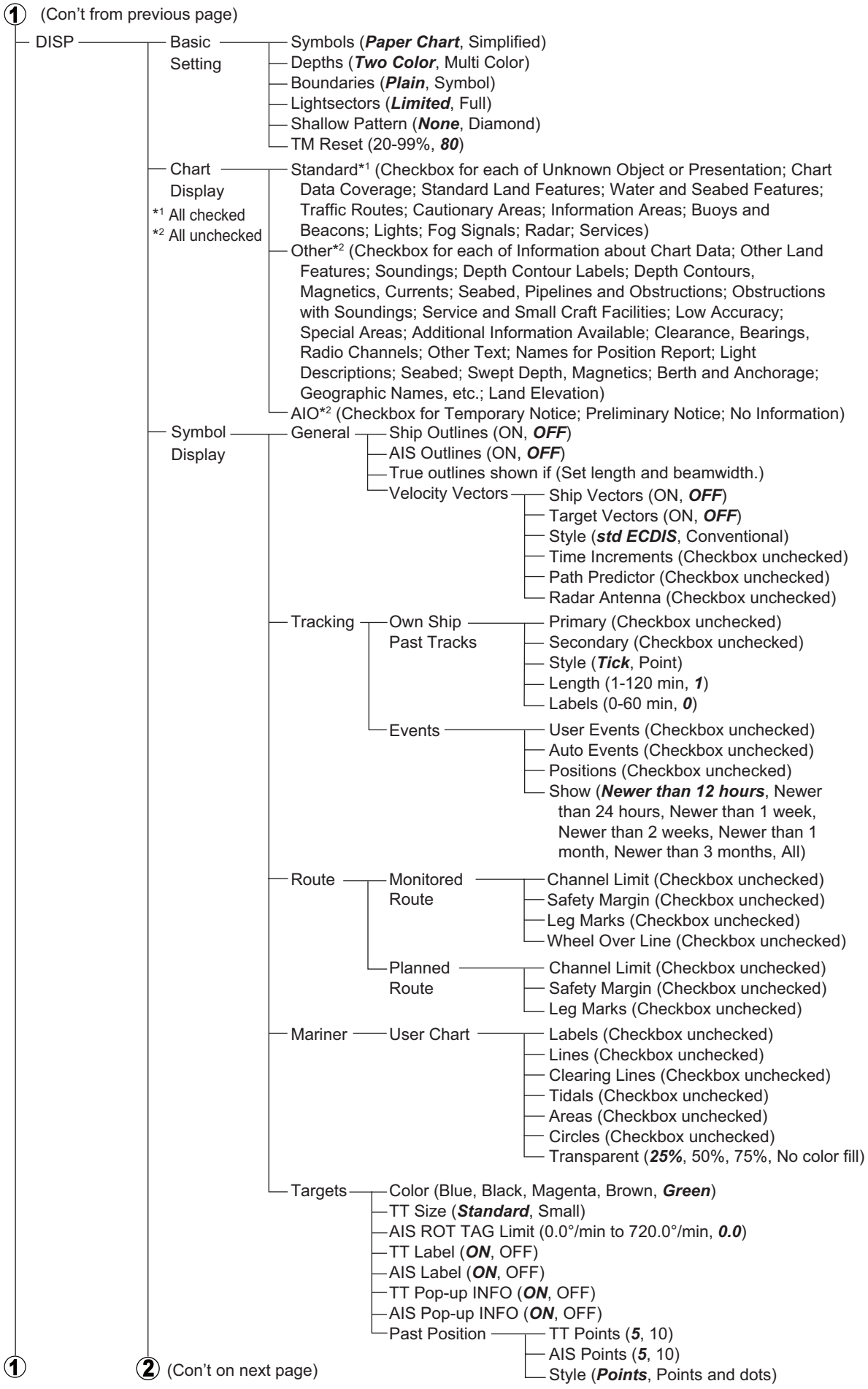
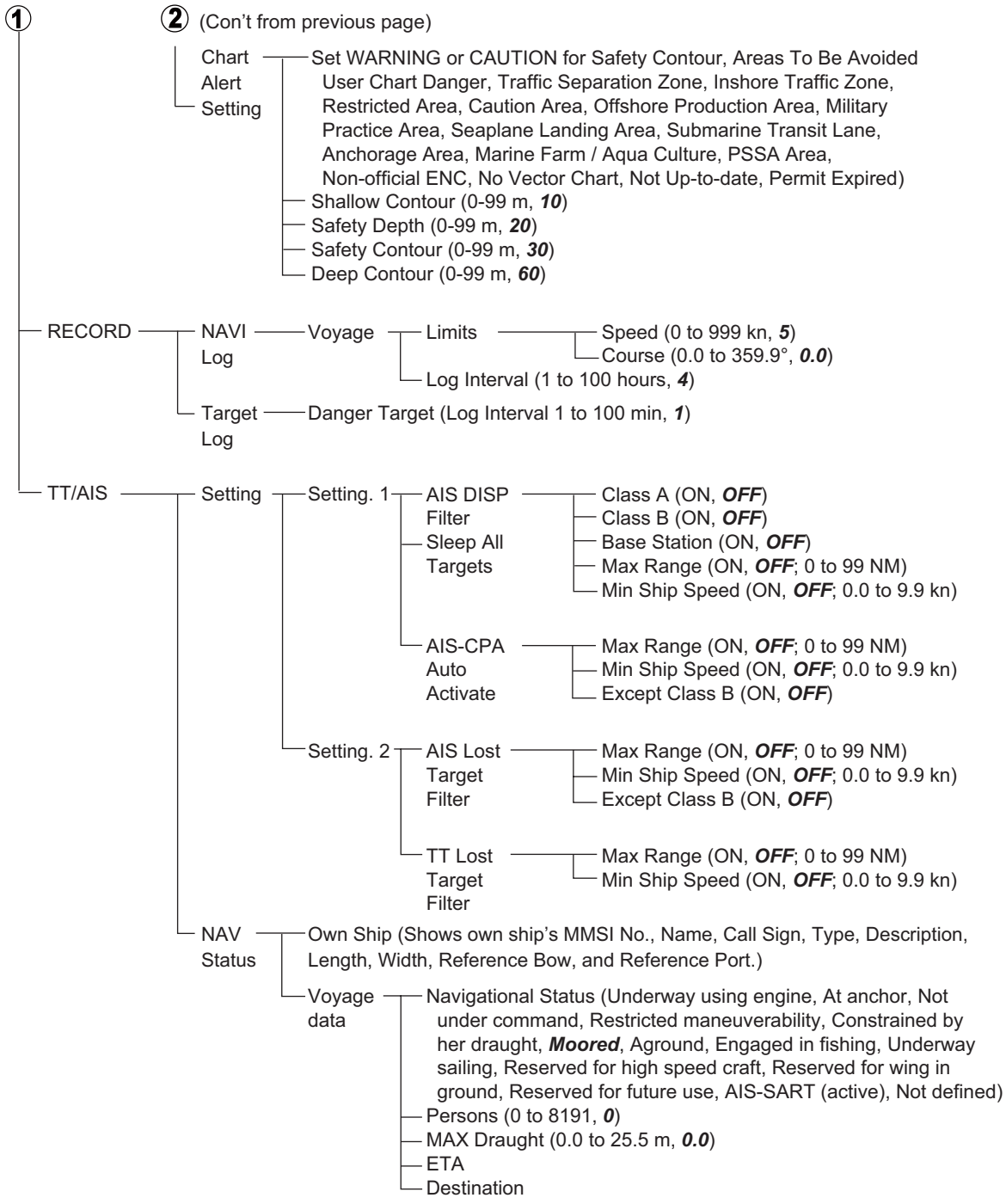


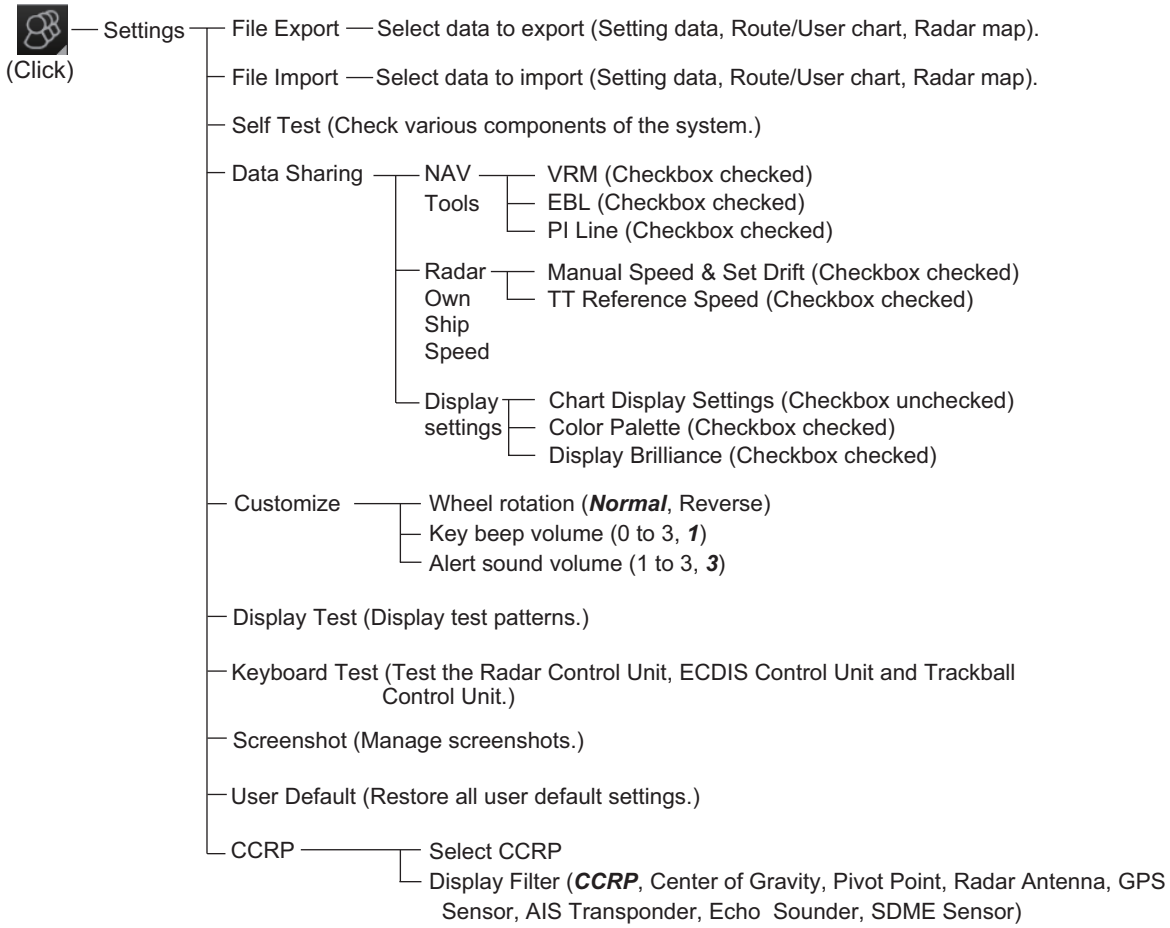
Chart menu


MENU bar
(click)
General
Ship & Route Parameters
Ship Parameters
MAX Speed (0.8 to 80 kn, 22.1)
MAX Height (0.0 to 100 m, 16.1)
MAX Draught (0.0 to 100 m, 20.0)
Route Parameters
Max R.O.T (5 to 200°, 60)
Turn End Tolerance (2 to 5°, 3)
WPT Approach (30 to 60 sec, 30)
WPT Prewarning (75 to 198 sec, 90)
Start Limit (5 to 45°, 40)
Default Line Radius (0.1 to 3.0 NM, 0.8)
Default CH Limit (10 to 5000 m, 185)
Default Safety Margin (0 to 2000 m, 40)
Gyro Error (ON, OFF)
Cost Parameters
Cost (Input values for Hour, Heavy Fuel Oil, Diesel Oil)
Fuel Consumption (Input values for Speed, Heavy Fuel Oil, Diesel Oil)
Sensor
System/Local Select
Sensor Type (System Sensor, Local Sensor)
System Sensor Settings
HDG
Data Source (Sensors, Manual)
SPD
Stabilization Mode (Bottom, Water)
Sensor Type (GPS, LOG)
Data Source (Sensors, Manual)
COG/SOG
Data Source (Sensors)
POSN
Data Source (Sensors, DR)
Local Sensor Settings
HDG
Sensors
Analog Gyro (No use)
Manual
SPD
Stabilization Mode (Bottom, Water)
Sensor Type (GPS, LOG)
Data Source (Sensors, Manual, Reference SPD, Drift)
COG/SOG
Data Source (Sensors)
POSN
Data Source (Sensors, DR)
Other Sensor Settings
Other Sensor
Wind
Speed (kn, m/s)
Reference (APPARENT, NORTH, THEORETICAL)
Depth Below Trans.
(Values for Bow, Mid and Aft)
Temperature (Temperature of water surface)
Water Current (Course and speed of water current)
Filter Status (Monitor status and integrity of sensors.)
1 (Con't on next page)


1 (Con't from previous page)
DISP
Basic Setting
Symbols (Paper Chart, Simplified)
Depths (Two Color, Multi Color)
Boundaries (Plain, Symbol)
Lightsectors (Limited, Full)
Shallow Pattern (None, Diamond)
TM Reset (20-99%, 80)
Chart Display
*1 All checked
*2 All unchecked
Standard*1 (Checkbox for each of Unknown Object or Presentation; Chart Data Coverage; Standard Land Features; Water and Seabed Features; Traffic Routes; Cautionary Areas; Information Areas; Buoys and Beacons; Lights; Fog Signals; Radar; Services)
Other*2 (Checkbox for each of Information about Chart Data; Other Land Features; Soundings; Depth Contour Labels; Depth Contours, Magnetics, Currents; Seabed, Pipelines and Obstructions; Obstructions with Soundings; Service and Small Craft Facilities; Low Accuracy; Special Areas; Additional Information Available; Clearance, Bearings, Radio Channels; Other Text; Names for Position Report; Light Descriptions; Seabed; Swept Depth, Magnetics; Berth and Anchorage; Geographic Names, etc.; Land Elevation)
AIO*2 (Checkbox for Temporary Notice; Preliminary Notice; No Information)
Symbol Display
General
Ship Outlines (ON, OFF)
AIS Outlines (ON, OFF)
True outlines shown if (Set length and beamwidth.)
Velocity Vectors
Ship Vectors (ON, OFF)
Target Vectors (ON, OFF)
Style (std ECDIS, Conventional)
Time Increments (Checkbox unchecked)
Path Predictor (Checkbox unchecked)
Radar Antenna (Checkbox unchecked)
Tracking
Own Ship Past Tracks
Primary (Checkbox unchecked)
Secondary (Checkbox unchecked)
Style (Tick, Point)
Length (1-120 min, 1)
Labels (0-60 min, 0)
Events
User Events (Checkbox unchecked)
Auto Events (Checkbox unchecked)
Positions (Checkbox unchecked)
Show (Newer than 12 hours, Newer than 24 hours, Newer than 1 week, Newer than 2 weeks, Newer than 1 month, Newer than 3 months, All)
Route
Monitored Route
Channel Limit (Checkbox unchecked)
Safety Margin (Checkbox unchecked)
Leg Marks (Checkbox unchecked)
Wheel Over Line (Checkbox unchecked)
Planned Route
Channel Limit (Checkbox unchecked)
Safety Margin (Checkbox unchecked)
Leg Marks (Checkbox unchecked)
Mariner
User Chart
Labels (Checkbox unchecked)
Lines (Checkbox unchecked)
Clearing Lines (Checkbox unchecked)
Tidals (Checkbox unchecked)
Areas (Checkbox unchecked)
Circles (Checkbox unchecked)
Transparent (25%, 50%, 75%, No color fill)
Targets
Color (Blue, Black, Magenta, Brown, Green)
TT Size (Standard, Small)
AIS ROT TAG Limit (0.0°/min to 720.0°/min, 0.0)
TT Label (ON, OFF)
AIS Label (ON, OFF)
TT Pop-up INFO (ON, OFF)
AIS Pop-up INFO (ON, OFF)
Past Position
TT Points (5, 10)
AIS Points (5, 10)
Style (Points, Points and dots)
1
2 (Con't on next page)


①
② (Con't from previous page)
Chart Alert Setting
Set WARNING or CAUTION for Safety Contour, Areas To Be Avoided User Chart Danger, Traffic Separation Zone, Inshore Traffic Zone, Restricted Area, Caution Area, Offshore Production Area, Military Practice Area, Seaplane Landing Area, Submarine Transit Lane, Anchorage Area, Marine Farm / Aqua Culture, PSSA Area, Non-official ENC, No Vector Chart, Not Up-to-date, Permit Expired)
Shallow Contour (0-99 m, 10)
Safety Depth (0-99 m, 20)
Safety Contour (0-99 m, 30)
Deep Contour (0-99 m, 60)
RECORD
NAVI Log
Voyage
Limits
Speed (0 to 999 kn, 5)
Course (0.0 to 359.9°, 0.0)
Log Interval (1 to 100 hours, 4)
Target Log
Danger Target (Log Interval 1 to 100 min, 1)
TT/AIS
Setting
Setting. 1
AIS DISP Filter
Sleep All Targets
Class A (ON, OFF)
Class B (ON, OFF)
Base Station (ON, OFF)
Max Range (ON, OFF; 0 to 99 NM)
Min Ship Speed (ON, OFF; 0.0 to 9.9 kn)
AIS-CPA Auto Activate
Max Range (ON, OFF; 0 to 99 NM)
Min Ship Speed (ON, OFF; 0.0 to 9.9 kn)
Except Class B (ON, OFF)
Setting. 2
AIS Lost Target Filter
Max Range (ON, OFF; 0 to 99 NM)
Min Ship Speed (ON, OFF; 0.0 to 9.9 kn)
Except Class B (ON, OFF)
TT Lost Target Filter
Max Range (ON, OFF; 0 to 99 NM)
Min Ship Speed (ON, OFF; 0.0 to 9.9 kn)
NAV Status
Own Ship (Shows own ship's MMSI No., Name, Call Sign, Type, Description, Length, Width, Reference Bow, and Reference Port.)
Voyage data
Navigational Status (Underway using engine, At anchor, Not under command, Restricted maneuverability, Constrained by her draught, Moored, Aground, Engaged in fishing, Underway sailing, Reserved for high speed craft, Reserved for wing in ground, Reserved for future use, AIS-SART (active), Not defined)
Persons (0 to 8191, 0)
MAX Draught (0.0 to 25.5 m, 0.0)
ETA
Destination

Settings menu



APPENDIX 2 ABBREVIATIONS, SYMBOLS

Abbreviations

Abbreviation	Meaning
ACQ	Acquire
ACT	Activate
ADJ	Adjustment
AIS	Automatic Identification System
ANT	Antenna
Apr	April
ATON	Aid To Navigation
Aug	August
AUTO	Automatic
BB	Blackbox
BCR	Bow Cross Range
BCT	Bow Cross Time
BLU	Blue
BRG	Bearing
BT	Bottom Tracking
Caps	Capital (letters)
CAT	Category
CCRP	Common Consistent Reference Position
COG	Course over the ground
CORRE	Correlation
CPA	Closest Point of Approach
CPU	Central Processing Unit
CSE	Course
CU/TM	Course-up/True Motion
CYA	CYAN
Dec	December
DEMO	Demonstration
DISP	Display
DR	Dead Reckoning

Abbreviation	Meaning
E	English
E	East
ETA	Estimated Time of Arrival
EXT	External
Feb	February
FILT	Filter
GPS	Global Positioning System
GRN	Green
GRY	Gray
Gyro	Gyrocompass
HDG	Heading
IMO	International Maritime Organization
IND	Indication
INS	Integrated Navigation System
J	Japanese
Jan	January
Jul	July
Jun	June
kyd	kiloyard
L	Long (pulse length)
L/L	Latitude/Longitude
LAN	Local Area Network
LL	Latitude, Longitude
LO	Low
MAG	Magnetic or Magenta
MAN	Manual
Mar	March
MAX	Maximum
MID	Middle
min	minute
MIN	Minimum
MMSI	Maritime Mobile Service Identity
MOB	Man Overboard
MON	Monitor

Abbreviation	Meaning
Navtex	Navigational Telex
NM	Nautical miles
NO.	Number
N	North
Nov	November
Oct	October
OS	Own Ship
PC	Personal Computer
PERPENDIC	Perpendicular
PI	Parallel Index (lines)
POSN	Position
R	Relative
REF	Reference
Rel	Relative
RM	Relative Motion
RNG	Range
ROT	Rate of Turn
S	South
S1 (2)	Short1(2) (pulse length)
SAR	Search And Rescue
SART	Search And Rescue Transponder
SEL	Select
Sep	September
SM	Statute Miles
SOG	Speed Over the Ground
SPD	Speed
SPEC	Specification
STAB	Stabilization
STBY	Stand-by
SW	Switch
T	True
TB	True Bearing
TCPA	Time to Closest Point of Approach
TGT	Target

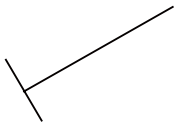
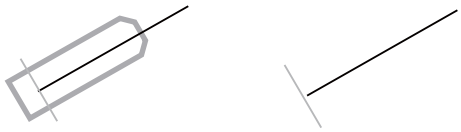
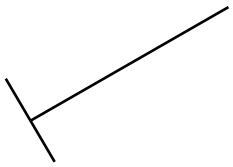
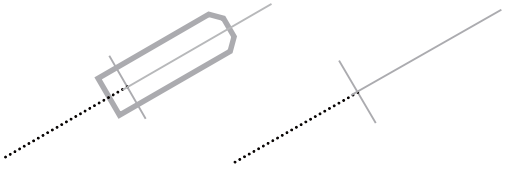
Abbreviation	Meaning
TGT, TGTS	Target, Targets
TM	True Motion
True-G	True-ground
True-S	True-sea
TT	Tracked Target or Target Tracking
TTD	Tracked Target Data
TTG	Time to go
TTM	Tracked Target Information
TX	Transmit
UTC	Universal Time, Coordinated
VECT	Vector
VRM	Variable Range Marker
W	West
W/O	Without
WHT	White
WPT	Waypoint
WT	Water Tracking
YEL	Yellow

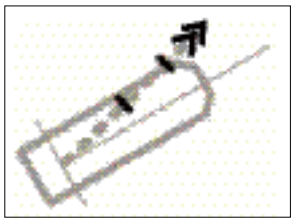
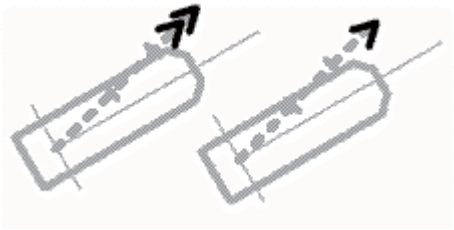
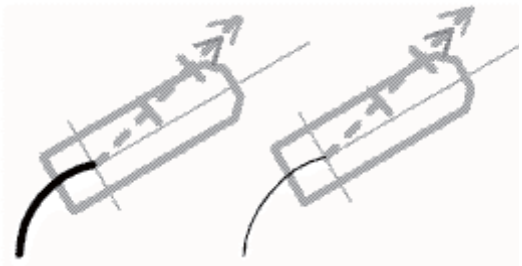
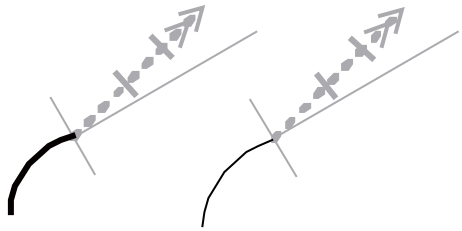
Symbols

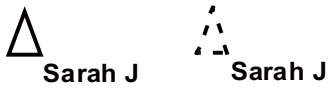
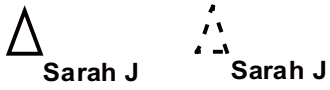
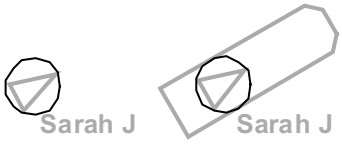
Symbols on Control Unit

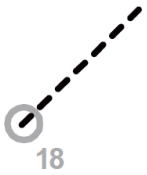
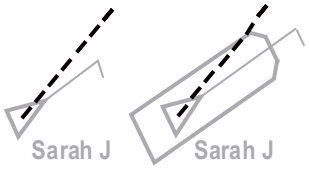
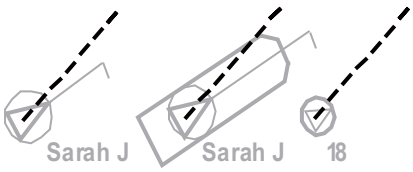
Symbol	Name
	Power switch
	Gain

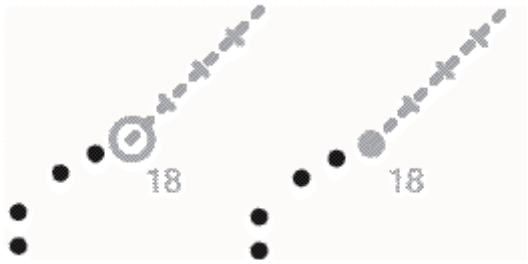
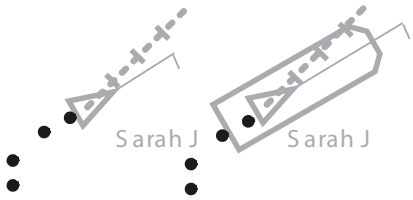
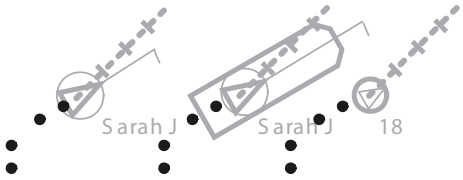
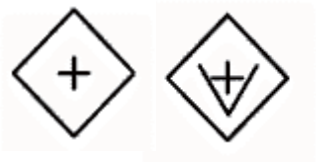
Symbols on display

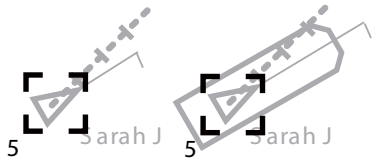
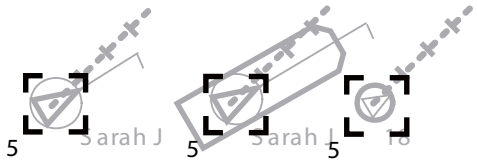
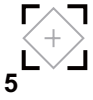
Symbol name and description	Symbol graphic(s)
Own ship - true scaled outline This can be displayed when based on user selection either beam width or length is more than 6 mm.	
Own ship - simplified symbol	
Own ship - minimized symbol	
Radar antenna position This symbol indicates location of the radar antenna. Select if position of radar antenna is displayed with symbol + in [MARK SETTING] menu.	
Own ship heading line This line originates from CCRP or Radar antenna position. CCRP: Consistent Common Reference Point	
Beam line This line passes through the CCRP or radar antenna position.	
Stern line	

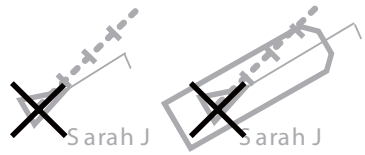
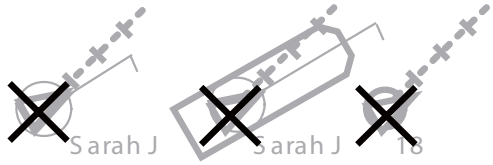
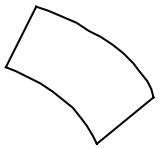
Symbol name and description	Symbol graphic(s)
Velocity vector - time increments	
Velocity vector - stabilization indicator Ground stabilization is indicated by double arrow-head and water stabilization is indicated as single arrowhead.	
Past track System past track is indicated by thick line. Raw sensor primary past track is indicated by thin line. Raw sensor secondary past track is indicated by grey thin line.	 
Radar targets in acquisition state	 5 mm in diameter
Radar targets in acquisition state - automatically detected Automatically detected target symbol is red and it flashes until acknowledged.	 5 mm in diameter
Tracked radar targets	 18 3 mm in diameter
Tracked radar targets - dangerous targets Dangerous target symbol is red and it flashes until acknowledged.	 18
Reference targets TT: Std or small user selection by Symbol Display.	 R4 18

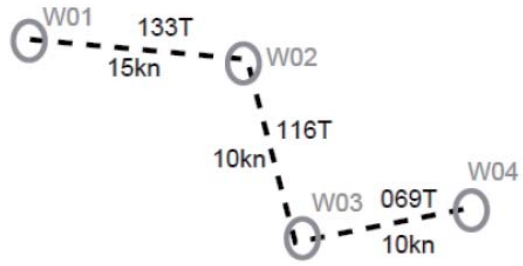
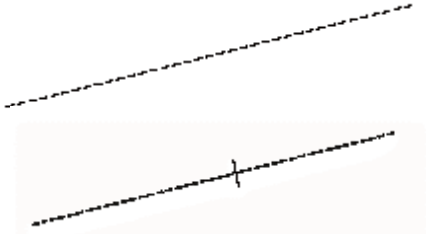
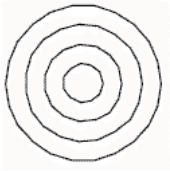
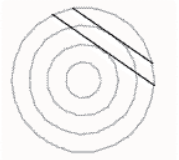
Symbol name and description	Symbol graphic(s)
Sleeping AIS targets Orientation is towards heading (or COG if heading unknown). If both heading and COG are unknown the orientation is toward top of display.	 Sleeping AIS target with neither reported heading nor COG 
Activated AIS targets Orientation is towards heading (or COG if heading unknown). If both heading and COG are unknown the orientation is toward top of display.	 Activated AIS target with neither reported heading nor COG 
Activated AIS targets - true scaled outlines • This can be displayed when based on user selection either beam width or length is more than 7.5 mm. • AIS outline: ON/OFF	
Activated AIS targets - dangerous targets Dangerous target symbol is red and it flashes until acknowledged.	 Activated AIS target with neither reported heading nor COG 
Activated AIS targets - alternative	Associated targets represented by AIS target symbols  Associated targets represented by radar target symbols 

Symbol name and description	Symbol graphic(s)
Activated AIS targets - heading lines	
Activated AIS targets - heading lines - turn indicators	
Velocity vectors	Radar target velocity vectors 
	AIS target velocity vectors 
	Associated target velocity vectors 

Symbol name and description	Symbol graphic(s)
Target past positions	Radar target past positions 
	AIS target past positions 
	Associated target past positions 
AIS aid to navigation (ATON) Real ATON is without "V" and virtual ATON is with "V". An ATON in off position is red.	
AIS search and rescue transmitter -SART	

Symbol name and description	Symbol graphic(s)
Selected targets	Selected radar targets 
	Selected AIS targets 
	Selected association targets 
	Selected AIS ATON 
	Selected AIS SART 

Symbol name and description	Symbol graphic(s)
Lost targets Lost target symbol is red and it flashes until acknowledged.	Lost radar targets  Lost AIS targets  Lost associated targets  LOST AIS ATON  Lost AIS SART 
Radar and AIS target acquisition area	
AIS SAR aircraft	
Waypoint	
Next waypoint	

Symbol name and description	Symbol graphic(s)
Routes	
Event marker	
User cursor	
Electronic bearing line (EBL) Second example show with range marker.	
Variable range marker (VRM)	
Range rings	
Parallel index lines	
Trial maneuver Displayed (flashing) during trial maneuver.	T
Simulation mode Displayed (flashing) during TT performance test.	S
Drop mark	

Radar map symbols

IMO and A types			
Category	**Symbol**	**Color***	**Name**
Mark		Red	Buoy 1
		Green	Buoy 2
		Red	Buoy 3
		Green	Buoy 4
		Red	Buoy 5
		Green	Buoy 6
		Red	Buoy 7
		Green	Buoy 8
		Purple	Wreck/Danger 1
		Purple	Wreck/Danger 2
		Orange	Mark 1
		Orange	Mark 2
		Orange	Mark 3
Line		Purple	Route 1
		White	Coastline 1
		Gray	Depth contour 1
		Purple	Prohibited area 1
		Purple	Wreck 3
		Orange	Mark 4
		Orange	Mark 5

*Fixed

B-type			
Category	**Symbol**	**Color**	**Name**
Mark		7 colors	Buoy 1
		7 colors	Buoy 2
		7 colors	Buoy 3
		7 colors	Buoy 4
		7 colors	Wreck/Danger 1
		7 colors	Wreck/Danger 2
		7 colors	Mark 1
		7 colors	Mark 2
		7 colors	Mark 3
		7 colors	Mark 4
		7 colors	Mark 5
		7 colors	Mark 6
		7 colors	Mark 7
Line		7 colors	Mark 8
		7 colors	Mark 9
		7 colors	Nav line
		7 colors	Coast line
		7 colors	Contour line
		7 colors	Prohibited area
		7 colors	Wreck/Danger 3
		7 colors	Buoy 5
		7 colors	Mark 10
		7 colors	Mark 11
		7 colors	Mark 12

Symbols on operating buttons

Symbol	Meaning
	Minimize button (on InstantAccess bar).
 MSG	Access AIS, Navtex functions (chart mode)
 AIS	Display received AIS message (radar mode)
	Access user profile, common settings
	Information (show program no., operator's manual)
	Undo, redo
	Screenshot capture
	Monitor brilliance (FURUNO monitor only)
	Color palette selection

APPENDIX 3 DIGITAL INTERFACE

Digital Interface

Input sentence

ABK, ACK, ALR, CUR, DBT, DPT, DTM, GGA, GLL, GNS, HDT, MTW, MWV, RMC, THS, VBW, VDM, VDO, VDR, VHW, VTG, ZDA

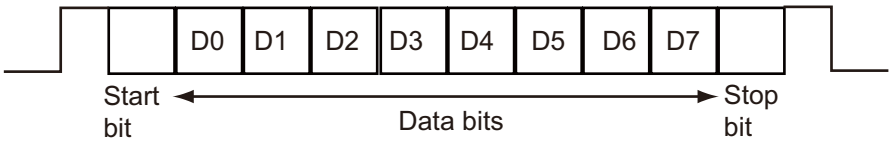
Output sentences

ABM, ACK, ALR, BBM, EVE, OSD, RSD, TLB, TTD, TTM, VSD

Data reception

Data is received in serial asynchronous form in accordance with the standard referenced in IEC 61162-2.

The following parameters are used:
Baud rate: 38,400 bps (HDT, THS, !AIVDM, !AIVDO, !AIABK, $AIALR). The baud rate of all other sentences is 4800 bps
Data bits: 8 (D7 = 0), Parity: none, Stop bits: 1



Data Sentences

Input sentences

ABK - UAIS Addressed and binary broadcast acknowledgement

$**ABK,xxxxxxxxx,x,x.x,x,x,*hh<CR><LF>
1 2 3 4 5

1. MMSI of the addressed AIS unit (9 digits)
2. AIS channel of reception (No use)
3. Message ID (6, 8, 12, 14)
4. Message sequence number (0 - 9)
5. Type of acknowledgement (See below)
   1 = message was broadcast (6 or 12), but not ACK by addressed AIS unit
   2 = message could not be broadcast (quantity of encapsulated data exceeds five slots)
   3 = requested broadcast of message (8, 14 or 15) has been successfully completed
   4 = late reception of message (7 or 13) ACK that was addressed to this AIS unit (own ship and referenced a valid transaction
   5 = message has been read and acknowledged on a display unit.

ACK - Acknowledge alarm

$**ACK,xxx,*hh<CR><LF>
1
1. Local alarm number (identifier) (000 - 999)

ALR - Set alarm state

$**ALR,Hhmmss.ss,xxx,A,A,c—c,*hh<CR><LF>
1 2 3 4 5
1. Time of alarm condition change, UTC (000000.00 - 235960.99)
2. Unique alarm number (identifier) at alarm source (000 - 999)
3. Alarm condition (A=threshold exceeded, V=not exceeded)
4. Alarm acknowledge state (A=acknowledged, V=not acknowledged)
5. Alarm description text (alphanumeric characters, max. 32)

CUR - Current

$**CUR,A,x,x.x,x.x,x.x,a,x.x,x.x,x.x,a,a,*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11
1. Validity of data (A=valid, V=not valid)
2. Data set number (0 - 9)
3. Layer number (0.0 - 3.0)
4. Current depth in meters (No use)
5. Current direction in degrees (0.00 - 360.00)
6. Direction reference in use (true or relative)
7. Current speed in knots (0.00 - 99.99)
8. Reference layer depth in meters (No use)
9. Heading (0 to 360.00)
10. Heading reference in use (true or magnetic)
11. Speed reference (B=Bottom track W=Water track P=Positioning system)

DBT - Depth below transducer

$**DBT,xxxx.x,f,xxxx.x,M,xxxx.x,F,*hh<CR><LF>
1 2 3 4 5 6
1. Water depth (0.00-99999.99)
2. feet
3. Water depth (0.00-99999.99)
4. Meters
5. Water depth (0.00-99999.99)
6. Fathoms

DPT - Depth

$**DPT,x.x,x.x,x.x,*hh<CR><LF>
1 2 3
1. Water depth relative to the transducer, meters (0.00-99999.99)
2. Offset from transducer, meters (No use)
3. Minimum range scale in use (No use)

DTM - Datum reference

$**DTM,ccc,a,x.x,a,x.x,a,x.x,ccc,*hh<CR><LF>
1 2 3 4 5 6 7 8
1. Local datum (W84=WGS84 W72=WGS72 S85=SGS85, P90=PE90
2. Local datum subdivision code (NULL or one character)
3. Lat offset, min (0 - 59.99999)
4. N/S
5. Lon offset, min (0 - 59.99999)
6. E/W
7. Altitude offset, meters (No use)
8. Reference datum (W84=WGS84 W72=WGS72 S85=SGS85, P90=PE90)

GGA - Global positioning system fix data

$**GGA,hhmmss.ss,llll.lll,a,yyyyy.yyy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx,*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11 12 13 14
1. UTC of position (no use)
2. Latitude (0000.00000 - 9000.00000)
3. N/S
4. Longitude (0000.00000 - 18000.00000)
5. E/W
6. GPS quality indicator (1 - 8)
7. Number of satllite in use (No use)
8. Horizontal dilution of precision (0.0 - 999.9)
9. Antenna altitude above/below mean sealevel (No use)
10. Unit, m (No use)
11. Geoidal separation (No use)
12. Unit, m (No use)
13. Age of differential GPS data (0 - 999)
14. Differential reference station ID (No use)

GLL - Geographic position, latitude/longitude

$**GLL,llll.lll,a,yyyyy.yyy,a,hhmmss.ss,a,x,*hh<CR><LF>
1 2 3 4 5 6 7
1. Latitude (0000.00000 - 9000.00000)
2. N/S
3. Longitude (0000.00000 - 18000.00000)
4. E/W
5. UTC of position (No use)
6. Status (A=data valid V=data invalid)
7. Mode indicator (A=Autonomous D=Differential E=Estimated M=Manual input S=Simulator)

GNS - GNSS fix data

$**GNS,hhmmss.ss,llll.lll,a,IIIII.III,a,c--c,xx,x.x,x.x,x.x,x.x,x.x,x.x,a*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11 12 13

1. UTC of position (no use)
2. Latitude (0000.00000 - 9000.00000)
3. N/S
4. Longitude (0000.00000 - 18000.00000)
5. E/W
6. Mode indicator (P, R, D, F, A, E, M, S)
   N=No fix A=Autonomous D=Differential P=Precise R=Real Time Kinematic
   F=Float RTK E=Estimated Mode M=Manual Input Mode S=Simulator Mode
7. Total number of satellites in use (No use)
8. HDOP (0.00 - 999.99)
9. Antenna altitude, meters (-999.99 - 9999.99)
10. Geoidal separation (No use)
11. Age of differential data (0 - 99)
12. Differential reference station ID (No use)
13. Naivgational status indicator (S=Safe, C=Caution, U=Unsafe, V=Not valid)

HDT - Heading, true

$**HDT,xxx.x,T*hh<CR><LF>
1 2

1. Heading, degrees (0.00 to 360.00)
2. True (T)

MTW - Water temperature

$**MTW,x.x,C<CR><LF>
1

1. Water temperature, degrees C (-100.000 - 100.000

MWV - Wind speed and angle

$**MWV,x.x,a,x.x,a,A*hh<CR><LF>
1 2 3 4 5

1. Wind angle, degrees (0.00 - 360.00)
2. Reference (R/T)
3. Wind speed (0.00 - 9999.99)
4. Wind speed units (K=km/h M=m/s N=nm)
5. Status (A)

RMC - Recommended minimum specific GPS/TRANSIT data

$GPRMC,hhmmss.ss,A,llll.ll,a,yyyyy.yy,a,x.x,x.x,ddmmyy,x.x,a,a,a*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11 1213

1. UTC of position fix (000000 - 235959)
2. Status (A=data valid, V=navigation receiver warning)
3. Latitude (0000.00000 - 9000.0000)
4. N/S
5. Longitude (0000.00000 - 18000.0000)
6. E/W
7. Speed over ground, knots (0.00 - 99.94)
8. Course over ground, degrees true (0.0 - 360.0)
9. Date (010100 - 311299)
10. Magnetic variation, degrees E/W (0.00 - 180.0/NULL)
11. E/W
12. Mode indicator (A= Autonomous mode D= Differential mode S= Simulator
    F=Float RTK P=Precise R=Real time kinematic E=Estimated (DR) M=Manual
13. Navigational status indication (S=Safe C=Caution U=Unsafe V=Navigational status not valid)

THS - True heading and status

$**THS,xxx.x,a*hh<CR><LF>
1 2

1. Heading, degrees True (0.00 to 360.00)
2. Mode indicator (A=Autonomous S=Simulator)

VBW - Dual ground/water speed

$**VBW,x.x,x.x,x,x.x,x.x,x,x.x,x,x.x,x,*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10

1. Longitudinal water speed, knots (-99.949 - 99.949)
2. Transverse water speed, knots (-99.949 - 99.949, null)
3. Status: water speed, A=data valid V=data invalid
4. Longitudinal ground speed, knots (-99.949 - 99.949)
5. Transverse ground speed, knots (-99.949 - 99.949, null)
6. Status: ground speed, A=data valid V=data invalid
7. Stern transverse water speed, knots (-99.949 - 99.949)
8. Status: stern water speed, A=data valid V=data invalid
9. Stern transverse ground speed, knots (-99.949 - 99.949)
10. Status: stern ground speed, A=data valid V=data invalid

VDM - UAIS VHF data-link message

!AIVDM,x,x,x,x,s--s,x,*hh<CR><LF>
1 2 3 4 5 6

1. Total number of sentences needed to transfer the message (1 to 9)
2. Message sentence number (1 to 9)
3. Sequential message identifier (0 to 9, NULL)
4. AIS channel Number (A or B)
5. Encapsulated ITU-R M.1371 radio message (1 - 63 bytes)
6. Number of fill-bits (0 to 5)

VDO - UAIS VHFG data-link own vessel report

!AIVDO,x,x,x,x,s--s,x,*hh<CR><LF>
1 2 3 4 5 6
1. Total number of sentences needed to transfer the message (1 to 9)
2. Message sentence number (1 to 9)
3. Sequential message identifier (0 to 9, NULL)
4. AIS channel Number (A or B, NULL)
5. Encapsulated ITU-R M.1371 radio message (1 - 63 bytes)
6. Number of fill-bits (0 to 5)

VDR - Set and drift

$**VDR,x.x,T,x.x,M,x.x,N,*hh <CR><LF>
1 2 3 4 5 6
1. Direction, degrees (0.00 - 360.00, null)
2. T=True (fixed)
3. Direction, degrees (0.00 - 360.00, null)
4. M=Magnetic (fixed)
5. Current speed (0 - 99.99)
6. N=Knots (fixed)

VHW - Water speed and headings

$**VHW,x.x,T,x.x,M,x.x,N,x.x,K,*hh <CR><LF>
1 2 3 4 5 6 7 8
1. Heading, degrees (No use)
2. T=True (fixed, No use)
3. Heading, degrees (No use)
4. M=Magnetic (fixed, No use)
5. Speed, knots (0.00 - 99.94)
6. N=Knots (fixed)
7. Speed, knots (0.00 - 99.94)
8. K=km/hr (fixed)

VTG - Course over ground and ground speed

$**VTG,x.x,T,x.x,M,x.x,N,x.x,K,a,*hh <CR><LF>
1 2 3 4 5 6 7 8 9
1. Course over ground, degrees (0.00 - 360.00)
2. T=True (fixed)
3. Course over ground, degrees (No use)
4. M=Magnetic (No Use)
5. Speed over ground, knots (0.00-99.94)
6. N=Knots (fixed)
7. Speed over ground (0.00-99.94)
8. K=km/h (fixed)
9. Mode indicator (A=Autonomous, D=Differential E=Estimated (dead reckoning)
M=Manual input S=Simulator P=Precision)

ZDA - Time and date

$**ZDA,hhmmss.ss,xx,xx,xxxx,xx,xx<CR><LF>
1 2 3 4 5 6
1. UTC (000000.00 - 235960.99)
2. Day (01 - 31)
3. Month (01 -12)
4. Year (UTC, 1970 - 2037)
5. Local zone, hours (No use)
6. Loca zone, minutes (No use)

Output sentences

For ACK and ALR see input sentences.

ABM - UAIS Addressed binary and safety related message

!**ABM,x,x,x,xxxxxxxxx,x,x.x,s--s,x,*hh<CR><LF>
1 2 3 4 5 6 7 8
1. Total number of sentences needed to transfer the message (1 -
2. Message sentence number (1 - 9)
3. Message sequence identifier (0 - 3)
4. The MMSI of destination AIS unit for the ITU-R M.1371 messag
5. AIS channel for broadcast of the radio message (0 - 3)
6. VDL message number (6 or 12), see ITU-R M.1371

ACK - Acknowledge alarm

$**ACK,xxx,*hh<CR><LF>
1
1. Local alarm number (identifier) (000 - 999)

BBM - UAIS broadcast binary message

$**BBM,x,x,x,x,xx,s--s,x,*hh<CR><LF>
1 2 3 4 5 6 7
1. Total number of sentences needed to transfer the message (1 - 9)
2. Sentence number (1 - 9)
3. Sequential Message identifier (0 - 9)
4. AIS channel for broadcast of the radio message (0 - 3)
5. ITU-R M.1371 message ID (8 or 14)
6. Encapsulated data (1 - 63 bytes)
7. Number of fill-bits, 0 to 5

EVE - General event message

$ **EVE,hhmmss.ss,c--c,c--c*hh<CR><LF>
1 2 3
1. Event time (000000.00 - 235960.99)
2. Tag code used for identification of source of event (RA0001 - RA0010, EI0001 - EI0016, IN0001 - IN0016, II0001 - II0016)
3. Event description (OPERATION)

OSD- Own ship data

$**OSD,53.21,A,57.89,R,12.52,R,45.67,6.78,N*hh<CR><LF>
1 2 3 4 5 6 7 8 9

1. Heading, degrees true (0.00 - 359.99, null)
2. Heading status (A=data valid, V=data invalid)
3. Vessel course, degrees true (0.00 - 359.99, null)
4. Course reference (B/M/W/R/P, null)
   B=Bottom tracking log
   M=Manually entered
   W=Water referenced
   R=Radar tracking (of fixed target)
   P=Positioning system ground reference
5. Vessel speed (0.00 - 999.99, null)
6. Speed reference, B/M/W/R/P
7. Vessel set, degrees true, manually entered (0.00 - 359.99)
8. Vessel drift (speed), manually entered (0.00 - 99.99, null)
9. Speed units (N=Knots)

RSD - Radar system data

$RARSD,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,N,H*hh <CR><LF>
1 2 3 4 5 6 7 8 9 10 11 12 13

1. Origin 1 range, from own ship (0.000 - 999) (see note 2)
2. Origin 1 bearing, degrees from 0 (0.0 - 359.9) (see note 2)
3. Variable range marker 1(VRM1), range (0.000 - 999)
4. Bearing line 1(EBL1), degrees from 0 (0.0 - 359.9)
5. Origin 2 range (0.000 - 999.9) (see note 2)
6. Origin 2 bearing (0.0 - 359.9)(see note 2)
7. VRM2,.9 range (0.000 - 999)
8. EBL2, degrees (0.0 - 360.0)
9. Cursor range, from own ship (0.000 - 999)
10. Cursor bearing, degrees clockwise from 0 (0.0 - 359.9)
11. Range scale in use (0.0625 - 120)
12. Range units (K/N/S)
13. Display rotation (see note 1)

NOTES
1 Display rotation:
   C=Course-up, course-over-ground up, degrees true
   H=Head-up, ship's heading(center-line) 0 up
   N=North-up, true north is 0 up
2 Origin 1 and origin 2 are located at the stated range and bearing from own ship and provide for two independent sets of variable range markers (VRM) and electronic bearing lines (EBL) originating away from own ship position.

TLB - Target label

$**TLB,x.x,c--c,x.x,c--c,…,x.x,c--c*hh<CR><LF>
1 2 3 3

1. Target number “n” reported by the device (1 - 1023)
2. Label assigned to target “n” (TT=00 - 99, AIS=000000000 - 999999999)
3. Additional label pairs

TTD - Tracked target data

!**TTD,xx,xx,x,s--s,x*hh<CR><LF>
1 2 3 4 5
1. Total hex number of sentences need to transfer the message (1 - FF)
2. Hex sentence number (1 - FF)
3. Sequential message identifier (0 - 9)
4. Encapsulated trancked target data (6 bit binary-converted data)
5. Number of fill bits (0 - 5)

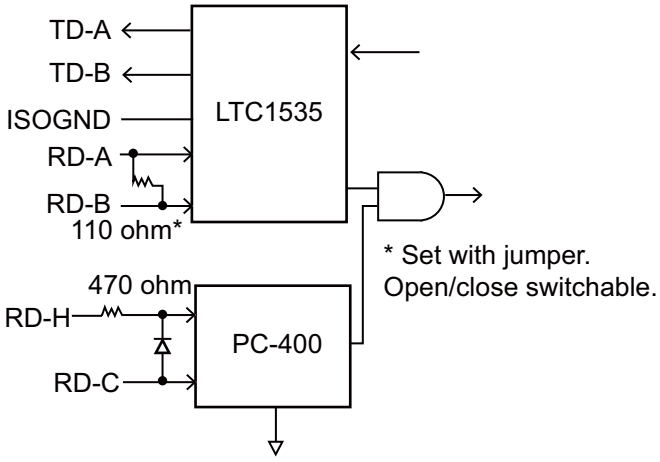
TTM - Tracked target message

$RATTM,05,12.34,23.4,R,45.67,123.4,T,1.23,8.23,N,c--c,T,R,hhmmss.ss,M*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1. Target number (00 to 999)
2. Target distance from own ship (0.000 - 99.999)
3. Bearing from own ship,degrees (0.0 - 359.9)
4. True or Relative (T)
5. Target speed (0.00 - 999.99, null)
6. Target course, degrees (0.0 - 359.9, null)
7. True or Relative
8. Distance of closet point of approach (0.00 - 99.99, null)
9. Time to CPA, min., "-" increasing (-99.99 - 99.99, null)
10. Speed/distance units (N=nm)
11. Target name (null)
12. Target status (L=Lost Q=Acquiring T=Tracking)
13. Reference target (R, NULL otherwise)
14. UTC of data (null)
15. Type of acquisition (A=Automatic M=Manual)

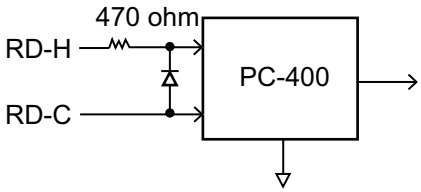
VSD - UAIS Voyage static data

$--VSD,x.x,x.x,x.x,c--c,hhmmss.ss,xx,xx,x.x,x.x*hh<CR><LF>
1 2 3 4 5 6 7 8 9
1. Type of ship and cargo category (0 - 255)
2. Maximum present static draught (0 to 25.5 meters, null)
3. Persons on-board (0 - 8191, null)
4. Destination (1 - 20 characters, null)
5. Estimated UTC of arrival at destination (000000.00 - 235959.99)
6. Estimated day of arrival at destination (00 to 31(UTC))
7. Estimated month of arrival at destination (00 to 12(UTC))
8. Navigational status (0 - 15, null)
9. Regional application flags (0 - 15)

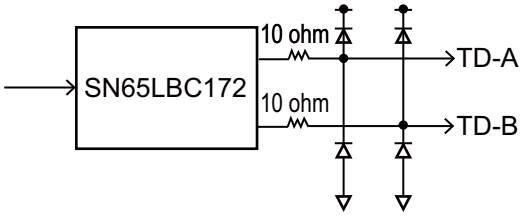
Serial Interface



Processor Unit: IEC 61162-2/1 input/output
Sensor Adapter: IEC 61162-2/1 input/output

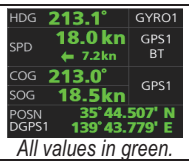
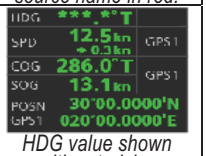
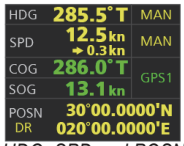


Processor Unit: IEC 61162-1 input
Sensor Adapter: IEC 61162-1 input



Processor Unit: IEC 61162-1 output
Sensor Adapter: IEC 61162-1 output

APPENDIX 4 DATA COLOR AND MEANING

	Indication color	Sensor color	HDG	L/L	SPD	COG/SOG	Display example
SYSTEM	GRN	WHT	THS-A HDT	GNS-A,D*,F,P,R GGA-1,2,3,4,5* GLL-A,D and (status: A)* RMC-A,D and (status: A)*	VBW-A VHW	VTG-A,D	 *All values in green.*
	YEL	WHT		DGPS update interval in GGA, GNS sentence is higher than 10 seconds. *1			 *Position in yellow characters.*
	RED	RED		GNS-E,M,S GGA-6,7,8 GLL-E,M,S or (status: V) RMC-E,M,S or(status: V)	VBW-V	VTG-E,M,S	 *SPD, COG, SOG and POSN values and pos. source name in red.*
	GRN (***.*)	WHT	THS-E,M, S, N	GNS-N, GGA-N, GLL-N, RMC-N		VTG-N	 *HDG value shown with asterisks.*
LOCAL	GRN	WHT	THS-A HDT	GNS-A,D*,F,P,R GGA-1,2,3,4,5* GLL-A,D and (status: A)* RMC-A,D and (status: A)*	VBW-A VHW	VTG-A,D	*Same as corresponding indication in SYSTEM.*
	YEL	WhT		DGPS update interval in GGA, GNS sentence is higher than 10 seconds.*1			*Same as corresponding indication in SYSTEM.*
	RED	RED		GNS-E,M,S GGA-6,7,8 GLL-E,M,S or (status: V) RMC-E,M,S or (status: V)	VBW-V	VTG-E,M,S	*Same as corresponding indication in SYSTEM.*
	GRN (***.*)	WHT	THS-E,M, S, N	GNS-N, GGA-N GLL-N, RMC-N		VTG-N	*Same as corresponding indication in SYSTEM.*
MANUAL	YEL	YEL (MAN) (DR)	Manual setting value	Manual setting value (Dead Reckoning)	Manual setting value		 *HDG, SPD and POSN values and "MAN" in yellow characters.*

*1 Navigational status in RMC sentence shown in “C”, “U” only (IEC 61162-1 ed4).

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SPECIFICATIONS OF MARINE RADAR
FCR-21x9-BB, FCR-28x9 SERIES

1 GENERAL

1.1 Model

Model	Frequency Band	Monitor	Output power (kW)	Transceiver location	Radiator length
FCR-2119-BB	X-band	User supply	12	In antenna unit	6.5/8 ft
FCR-2129-BB			25		
FCR-2819		MU-231	12		
FCR-2829			25		
FCR-2829W			25	TR unit	
FCR-2139S-BB	S-band	User supply	30	In antenna unit	12 ft
FCR-2839S		MU-231			
FCR-2839SW				TR unit	

1.2 Radar picture

Operating mode	Radar mode, chart radar mode, ECDIS mode
Presentation mode	Head-up/Head-up TB (RM), North-up (RM/TM), Course-up (RM) (RM: relative motion, TM: true motion)

2 MONITOR UNIT (MU-231)

2.1	Display	Color LCD, raster scan, daylight bright, radar echoes in 32 levels
2.2	Screen size	23.1-inch
2.3	Effective area	470.4 x 352.8 mm
2.4	Resolution	UXGA (1600 x 1200)
2.5	Effective radar diameter	335.2 mm
2.6	Visible distance	1.02 m nominal

3 ANTENNA UNIT

3.1	Type	Slotted waveguide array
3.2	Polarization	Horizontal
3.3	Wind resistance	Relative wind 100 kn

3.4 Beam width and sidelobe attenuation

	X-band		S-band
	XN20AF	XN24AF	SN36AF
Radiator length (ft)	6.5	8	12
Beam width (H)	1.23°	0.95°	1.8°
Beam width (V)	20°		25°
Sidelobe within ±10°	-28 dB		-24 dB
Sidelobe outside ±10°	-32 dB		-30 dB

3.5 Rotation

FCR- 2119-BB/2129-BB/2819/2829	24 rpm or 42 rpm (High Speed Craft: HSC)
FCR-2139S-BB/2839S	21 rpm (50 Hz)/26 rpm (60 Hz)/45 rpm (HSC)
FCR-2829W	24 rpm
FCR-2839SW	21 rpm (50 Hz)/26 rpm (60 Hz)

3.6 De-icer On: when temperature goes down to +5°C
Off: when temperature goes up to +12°C

4 RADAR TRANSCEIVER UNIT

4.1 Frequency
X-band: 9410 MHz ±30 MHz
S-band: 3050 MHz ±30 MHz

4.2 Output power
FCR-2119-BB/2819: 12 kW
FCR-2129-BB/2829/2829W: 25 kW
FCR-2139S-BB/2839S/2839SW: 30 kW
Unwanted emissions comply with ITU-R RR.

Pulselength (PL), Pulse Repetition Range (PRR) and Range Scale

Range	S1	S2	M1	M2	M3	L
PL (µs)	0.07	0.15	0.3	0.5	0.7	1.2
PRR (Hz)	3000*	3000*	1500	1000	1000	600**
Range Scale (NM)	0.125, 0.25, 0.5, 0.75, 1.5	0.5, 0.75, 1.5, 3	0.75, 1.5, 3, 6	3, 6, 12, 24	3, 6, 12, 24	6, 12, 24, 48, 96

*: 2200 Hz with TT range on 32 NM.

**: 500 Hz on 96 NM range

4.3 Duplexer
FCR-2119-BB/ 2129-BB/2819/2829/2829W/2139S-BB/2839S
Ferrite circulator with diode limiter
FCR-2839SW Ferrite circulator with TR limiter

4.4 Display-related specifications
Minimum range 22 m
Range discrimination 26 m
Range scales (NM), Range ring interval
0.125 (.025), 0.25 (0.05), 0.5 (0.1), 0.75 (0.25), 1.5 (0.25),
3 (0.5), 6 (1), 12 (2), 24 (4), 48 (8), 96 (16)
Range accuracy Within 1% or 10 m, whichever is greater
Bearing discrimination 1.5° (XN20AF), 1.2° (XN24AF), 2.0° (SN36AF)
Bearing accuracy ±1°
Radar map Route, Coastline, Buoy, etc. 4,000 pts in radar mode
Target tracking (TT) Acquisition: 0.1 to 32 NM, 100 targets
Auto tracking on all acquire targets
Vector time: Off/30s/1-60 minutes
Trail maneuver available
AIS Complies with IMO SN CIRC. 217, IEC60936-5
Capacity: 2000 targets
Past position: 5/10 pts on all activated targets
Time of vector: Off/30s/1-60 minutes

5 CHART INDICATION (ECDIS)

5.1 Display contents
Chart materials IMO/IHO S57-3 ENC or C-MAP CM-93/3 vectorized material
Own ship display Own ship mark/track and numeral position in lat/lon,
speed, course and heading
Target tracking (TT) Range, Bearing, Speed, Course, CPA/TCPA,
Target information from AIS
Other information Route, Waypoint, Nav line, Electronic chart information,
Various alarms

5.2 Display features Chart zoom-in/out, Cursor (EBL, VRM and parallel index lines),

		Scroll, Symbol select, One touch activation, Electric chart information auto-update
	One-touch restore	One-touch restore of standard mode
5.3	User interface	
	Position fixing	Navigation by position from external EPFS, Dead reckoning by gyro/log,
	Route planning	Planning by rhumb line, Great circle, Route creation
	Route monitoring	Off-track display, Waypoint arrival alarm, Shallow depth alarm, Route information indication
	User chart	User chart creation
	MOB (Man Overboard)	Position, etc. at time of man overboard are recorded and MOB mark is displayed on the screen.

6 INTERFACE

6.1	Processor unit (EC-3000)	
	Serial I/O	8 ports (IEC61162-1/2: 2 ports, IEC61162-1: 6 ports)
	Input	ABK, ABM, ALR, BBM, BWC, BWR, CUR, DBT, DPT, DTM, ETL, GBS, GGA, GLL, GNS, HDT, MTW, MWD, MWV, NRM, NRX, POS, PRC, RMB, RMC, ROR, ROT, RPM, RSA, RSD, RTE, THS,TLL, TRC, TTM, VBW, VDM, VDO, VDR, VHW, VLW, VTG, WPL, XDR, XTE, ZDA
	Output	AAM, ABM, ACK, BBM, CRQ, DDC, EVE, HTC, OSD, RSD, TLB, TLL,TTD, VBW, VDR, VSD, XTE,XTR
	Digital input	1 channel: contact signal, 100 ohm max. or 24VDC input
	Alarm output	6 channels: contact signal 0.5A/60V max. Normal close: 4, Normal open: 2 fixed
	DVI output	3 ports: DVI-I Ver1.1, picture data (1 port for VDR)
	USB	4 ports (3 ports for control units)
	LAN	3 ports: Ethernet 1000Base-T for network equipment, sensor adapter and spare
6.2	Sensor adapter (option)	
	MC-3000S (serial)	8 ports: I/O, IEC61162-1/2: 4 ports, IEC61162-1: 4 ports
	MC-3010A (analog)	3 ports: Input, -10 to +10V, 0 to 10V or 4 to 20mA
	MC-3020D (digital-in)	8 ports: relay contact, logics set from program
	MC-3030D (digital-out)	8 ports: relay contact, normal open and normal close available
6.3	Radar processor unit (RPU-013)	
	Heading signal	Sync signal (20-100VDC or 20-135 VAC, 50/60/400/500 Hz) or stepper signal (20-100 VDC), built-in interface (option) required, AD-10 format

7 POWER SUPPLY

7.1	Monitor unit (MU-231)	100-230 VAC, 1.0-0.6 A, 1 phase, 50/60 Hz
7.2	Processor unit (EC-3000)	100-115/220-230 VAC: 1.5-0.7 A, 1 phase, 50/60 Hz
7.3	Sensor adapter	24 VDC: 1.4 A (for 11 units), Input to MC-3000S, the sources of other sensor adapters are fed from MC-3000S
7.4	Radar processor unit (RPU-013)	
	FCR-2119-BB/2819	100-115 VAC: 2.6 A (3.0 A), 1 phase, 50/60 Hz 220-230 VAC: 1.6 A (1.7 A), 1 phase, 50/60 Hz

FCR-2129-BB/2829 100-115 VAC: 3.0 A (3.4 A), 1 phase, 50/60 Hz
220-230 VAC: 1.8 A (1.9 A), 1 phase, 50/60 Hz ( ): 42 rpm
FCR-2139S-BB/2839S/2839SW
100-115/220-230 VAC: 2.6/1.6 A, 1 phase, 50/60 Hz
FCR-2829W 100-115/220-230 VAC: 3.0/1.8 A, 1 phase, 50/60 Hz

7.5 Switching HUB 100-230V AC: 0.1 A max, 1 phase, 50/60 Hz

7.6 S-band antenna

Model	Antenna voltage input (at wind speed 100 kn)				
	200VAC,3ø,50Hz 220VAC,3ø,60Hz	380VAC,3ø,50Hz 440VAC,3ø,60Hz	220VAC, 3ø,50 Hz (HSC)	220VAC, 3ø,60Hz (HSC)	440VAC, 3ø,60 Hz (HSC)
FCR-2139S-BB	3.0A	1.5A	3.5A	3.5A	1.7A
FCR-2839S	3.0A	1.5A	3.5A	3.5A	1.7A
FCR-2839SW	3.0A	1.5A	-	-	-

8 ENVIRONMENTAL CONDITIONS

8.1 Ambient temperature
Antenna unit -25°C to +55°C (storage: -25°C to +70°C)
Others -15°C to +55°C

8.2 Relative humidity 93% or less at +40°C

8.3 Degree of protection
Antenna unit IPX6
Processor unit RPU-013: IPX0, EC-3000: IP20 (IP22: option)
Transceiver/power supply unit IPX0
Control/monitor unit IP22
Others IPX0 (IPX2 by specified mounting method, option)

8.4 Vibration IEC 60945 Ed.4

9 UNIT COLOR

9.1 Antenna unit N9.5
9.2 Processor/transceiver unit 2.5GY/1.5
9.3 Control unit N3.0
9.4 Monitor unit N2.5

10 PERFORMANCE MONITOR

10.1 PM-31 (X-band)
Frequency 9370 to 9450 MHz
Input power +8 dBm min., +28 dBm max.
Output power -36 dBm (2nd pulse max. output),
-56 dBm (2nd pulse min. output)
Step level 7.5 to 10.5 dB (1st pulse to 2nd pulse)

10.2 PM-51 (S-band)
Frequency 3020 to 3080 MHz
Input power +5 dBm, min., +15 dBm max.
Output power -15 dBm (2nd pulse max. output),
-35 dBm (2nd pulse min. output)
Step level 9.0 to 11.0 dB (1st pulse to 2nd pulse)

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Publication No. DOCQA0440

Declaration of Conformity

0735

We FURUNO ELECTRIC CO., LTD.

(Manufacturer)

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

(Address)

declare under our sole responsibility that the product

MARINE RADAR FCR-2XX9

(Model name, type number)

to which this declaration relates conforms to the following standard(s) or normative document(s)

IMO Resolution A.278(VIII)
IMO Resolution A.694(17)
IMO Resolution A.820(19)
IMO Resolution MSC.191(79)
IMO Resolution MSC.192(79)
ITU-R M.628-3
ITU-R M.1177-3
2000 HSC Code 13
IEC 62388 Ed. 1.0: 2007
IEC 61162-1 Ed. 4.0: 2010
IEC 61162-2 Ed. 1.0: 1998
IEC 62288 Ed. 1.0: 2008
IEC 60945 Ed. 4.0: 2002

(title and/or number and date of issue of the standard(s) or other normative document(s))

For assessment, see

- EC Type Examination (Module B) Certificate No.MED-B-8079 issued by DET NORSKE VERITAS (DNV), Norway.
- EC Quality System (Module D) Certificate No. BSH/4613/02208/2345/12 issued by Federal Maritime and Hydrographic Agency (BSH), The Federal Republic of Germany.

This declaration is issued according to the provisions of European Council Directive 96/98/EC on marine equipment and amending Directive 2011/75/EU and 2012/32/EU.

On behalf of Furuno Electric Co., Ltd.

Nishinomiya City, Japan
June 3, 2013

(Place and date of issue)

Yoshitaka Shogaki
Department General Manager
Quality Assurance Department

(name and signature or equivalent marking of authorized person)